AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
J	1 | 7

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0002	29-Oct-2001	W26GLG-1250-8095	

6. ISSUED BY CODE DACA65
CONTRACTING OFFICE (CA/CW)
US ARMY ENGR DIST NORFOLK ATTN:
CENAO-CT 803 FRONT STREET
NORFOLK VA 23510-1096

7. ADMINISTERED BY (If other than item 6) CODE
See Item 6

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)

CODE FACILITY CODE

X	9A. AMENDMENT OF SOLICITATION NO. DACA65-02-R-0001
X	9B. DATED (SEE ITEM 11) 12-Oct-2001
	10A. MOD. OF CONTRACT/ORDER NO.
	10B. DATED (SEE ITEM 13)

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [X] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Changes, Clarifications

POC
Susan Hurst
757-441-7747 757-441-7183
susan.i.hurst@usace.army.mil

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 29-Oct-2001

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

Changes in Section SF 30

Amendment 0002

1. Section 00100

    a. Page 16 of 51 paragraph 2.00.a.f is changed to read "… The proposals sought by this solicitation shall contain four categories …".
    b. Page 16 of 51. Section 00110, Add the following to paragraph 2.00.c

(3) The following material is excluded from the 60 count page limitation:
Pro Forma Requirements
Factor 2 Material (samples, catalog cuts and other related information)
Factor 4 Small Business Subcontracting Effort/Small Business Contracting Plan
Blank Index Tabs

All other material is included in the page count.

    c. Page 17 of 51, paragraph 2.00.f.4. Delete "subcontracting plan". Subcontracting plan, if applicable, is to be provided as a part of Factor 4.
    d. Page 18 of 51, Paragraph 2. Section 00110, Add the following sentence:

"…are of equal importance. Factor 4 is of lesser importance than Factor 3. Subfactors within Factor 4 are of equal importance. Award …"

    e. Page 17 of 51, paragraph 2.00.f.(c). Section 00110, Factor 3 information is to be included in same binder as the information for Factor 1. This information is included in the page count.
    f. All binders should be briefly and simply labeled to indicate the contents therein.

2. Section 00120
    a. Page 21 of 51, Paragraph 6. Delete "major" from first sentence.
    b. Page 19 of 51. Factor 1, Subfactor A. Historical buildings are considered to be those that are more than fifty years old and/or registered or eligible to be registered on State or Federal registers of historical buildings. In order to qualify under this factor, historical building/housing renovation projects must be over $10 million in value.
    c. Page 19 of 51. Factor 2, Subfactor B. Color of the sample window shall be EAGLE "Antique White" or equal.

3. Section 00800
    a. FAR Clause 52.211-12 is modified to include liquidated damages amounts as attached.
    b. Page 46 of 51, clause E4LC CONSTR 08 is included in full text.
    c. Page 50 of 51. Clauses E4LC CONSTR 20 and 21 are deleted.

4. Sheet G-003D

    a. Building 983 is a part of this project and does not require a new roof. Building 849 is not included in this project.

5. Technical Plans and specifications are amended. Make appropriate changes with the attached.

6. Pre-proposal conference minutes and attendance is attached. Questions raised in the conference are answered by the changes addressed herein.

7. SITE VISIT ATENDEES

Tim Hamilton	Encompass Electrical Technologies	757-436-1006
Pete Fraioli	Encompass Electrical Technologies	757-485-7745
Shawn Simpson	Encompass Electrical Technologies	757-485-7445
Michael Roy	Encompass Electrical Technologies	757-436-1006
Dan Kinsey	Gerloff Painting	757-857-4880
Bill Rinard	Gerloff Painting Inc	757-857-4880
Lawrence Saccone	Bering Stra its Development	703-961-8812
Don Dallman	Bering Straits Development	703-395-2286
Rod Freeman	OK James Const. Co.	757-253-0045
Parke Martin	JB Denny Company	757-631-0234
Thomas Starnes	Dobson Construction Co.	757-833-0086
Bob Stone	TLT Construction	781-438-4100
J.D. Miles	J.D. Miles & Sons Inc	757-545-5912
Steve Oistad	Sherwin Electric Co	804-222-2213
David Douglas	Sherwin Electric Co	804-222-2213
Rick Jakobowsky	WB Meredith II Inc	757-855-8067
Owen McLean	Chianelli Building Corp.	757-855-6100
Ray Showaller	Chianelli Building Corp.	757-855-6100
Doug Bevelacqua	The Phoenix Corp	757-223-1200
Doug Sanger	Kropper Group/DBA Sanger's Quality Roofing	804-914-7497
Rob Birch	Kropper Group/DBA Sanger's Quality Roofing	804-914-7497
Tracy Schmidt	Char Trac Inc	804-347-9818
Mark Williams	Char Trac Inc	804-347-9818

Attendees met 24 Oct 2001 at the 1 CES Conference Room.

Government representatives were:

James Kendell Army Corps of Engineers, Norfolk District 757-441-7703
Willie Williams. 1 CES, Langley AFB, 757-764-1386
Susan Hurst, Army Corps of Engineers, Norfolk District 757-441-7747

Solicitation requirements were discussed.

1. Proposal due date is currently 13 Nov 2001.
2. Any changes to the date will be made by amendment to the solicitation
3. Answers to questions asked are only binding if issued via amendment in writing.
4. Proposals are to be delivered to the Contracting Office, Army Corps of Engineers at the address specified in the solicitation. Material Samples are to be delivered to the Resident Office, Langley AFB at the specified address. Both are due at the time and date listed in the solicitation. Be aware of security requirements for base entry in making these deliveries.
5. Questions relative to the solicitation were discussed and are answered herein.
6. 4 units similar to or included in the project were toured.

Changes in Section 00700

The following clauses which are incorporated by full text have been added or modified:

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than .

General Officer Housing	912 Calendar Days
Enlisted Housing	730 Calendar days

Note 1: See Specification Section 01005

Note 2: Period of Performance shall be modified to conform to the contractor's proposal.

* The time stated for completion shall include final cleanup of the premises.

*The Contracting Officer shall specify either a number of days after the date the contractor receives the notice to proceed, or a calendar date.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of $144.00 per unit per for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

NOTE: Liquidated damages will be charged on a per housing unit basis. If the contractor is late on more than one housing unit at any given time the liquidated damages will be charged for each housing unit that is late. For example, if the contractor is late on five housing units, they will be then charged 5 times the daily rate per housing unit. The housing unit will be charged with liquidated damages until that housing unit is accepted.

(End of clause)

Changes in Section 00800

The following clauses have been deleted:

E4LC CONSTR 20	CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS	JAN 2000
E4LC CONSTR 21	SOLICITATION DOCUMENTS AND INFORMATION	JAN 2000

The following clauses which are incorporated by full text have been added or modified:

E4LC CONSTR 08 MAGNITUDE OF CONSTRUCTION PROJECT

The estimated contract price of the work for this project is between $_10,000,000____ and $__$15,000,000_____.

SECTION 01005

PROJECT WORK REQUIREMENTS AND RESTRICTIONS
07/00

PART 1 GENERAL

1.1 DEFINITIONS

a. Facility: The facility is Langley Air Force Base, Virginia.

b. CO: Contracting Officer or his authorized representative.

1.2 COOPERATION WITH USING AGENCY AND OTHER CONTRACTORS

During the period of this contract, other contracts may be in force for the construction of other features of work on or adjacent to the site of work being accomplished under this contract. It shall be the responsibility of the Contractor on this contract to be fully informed of the extent of the limits of work to be performed by other Contractors. Should there be any conflict between these limits, it shall be brought to the attention of the Contracting Officer and the CO's decision shall be final. Also, prior to completion of work under this contract, members of the Using Agency may be performing work or occupying facilities on or adjacent to the area. The Contractor shall arrange his plant and shall schedule and perform this work so as to effectively cooperate with all other Contractors and Government agencies.

1.3 PERSONNEL RESTRICTIONS

Personnel are limited to the immediate site areas and shall not enter buildings or facilities not involved in the work. All employees of the Contractor will be subject to all rules and regulations of the Facility which pertain to personnel. The Contractor shall erect fences and signs as specified and be responsible for the restrictions of all personnel. The Contractor's plans for restricting personnel access to the project site shall be submitted for approval as a part of the Safety Plan (Accident Prevention Plan).

1.4 TRANSPORTATION FACILITIES

The Facility is served by an all weather surfaced road network. Road(s) within the Facility proposed to be used by the Contractor shall be subject to prior approval of the Facility authorities and such roads, if used, shall be maintained throughout construction and shall be restored to as good condition as existed prior to their use. Any such temporary construction shall be removed and the affected area restored to its original condition. All costs for the use of existing transportation facilities, for the construction of temporary facilities, and for maintenance, repair, removal and restoration shall be borne by the Contractor.

1.4.1 Use of Roads

The Contractor shall keep all roads clear of all obstructions and free of mud and other foreign materials resulting from operations. The Contractor's vehicles shall at no time follow a vehicle closer than 50 feet, and all vehicles shall pull off the road and come to a complete stop when meeting emergency vehicles and vehicles with flashing lights. Facility

speed limits and traffic controls will be observed.

1.4.2 Road Restrictions

The movement of all vehicles within the Facility shall be confined to the roads designated and shall comply with traffic regulations within the Facility. Other roads may be used only with the approval of the CO.

1.4.2.1 Cleated Vehicles

Cleated vehicles shall not be moved over surfaced roads except at the immediate site of the area where they are to be used.

1.5 COORDINATION IN WORK AREAS

1.5.1 Unoccupied Work Area

The buildings in which the Contractor is scheduled to perform the work will not be occupied during the work. However, the Contractors work activities may affect other area(s) that are occupied. All work shall be in accordance with the Contractor's work plan.

1.5.2 Maintenance of Utilities

Any active utilities, including but not limited to electricity, gas, water, sewer, heating, air conditioning, or any like service, that will require interruption or replacement in any occupied area affected as a result of the Contractors scheduled work activities, shall be temporarily provided by the Contractor at his own expense until the affected service is fully and permanently restored. All temporary method(s) of service replacement the Contractor proposes for use on this contract shall be approved by the Contracting Officer prior to commencing the work.

1.5.3 Hours of Work

The normal work hours for construction shall be from 8:00 a.m. to 5:00 p.m., Monday through Friday of each week. Any request to change these hours shall be made in writing to the Contracting Officer at least two calendar days prior to the desired day on which the change is to go into effect. The changed hours shall not go into effect until written permission has been received from the Contracting Officer.

1.5.4 Digging Permits

Contractor is responsible for obtaining all digging permits, including associated locating and marking services, in accordance with installation and local requirements, at no additional cost to the Government.

1.6 INTERRUPTIONS OF UTILITIES

1.6.1 Approval

Utility services shall not be interrupted by the Contractor to relocate, make connections, or interrupt for any purpose, without written approval of the Contracting Officer.

1.6.2 Request

Request for permission to shut down services shall be submitted in writing

to the Contracting Officer not less than 10 calendar days prior to date of proposed interruption. The request shall give the following information:

a. Nature of Utility (Gas, L.P. or H.P., Water, Elec.)

b. Size of line and location of shutoff.

c. Buildings and services affected.

d. Hours and date of shutoff.

e. Estimated length of time service will be interrupted.

1.6.3 Service Interruptions

Services shall not be shut off until receipt of approval of the proposed hours and date from the Contracting Officer.

1.6.4 Timely Disconnections

Shutoffs which will cause interruption of Government work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or non-work days of the Using Agency without any additional cost to the Government.

1.6.5 Utilities Operation

Operation of valves on water mains will be by Government personnel. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Post Fire Department shall be notified by the Contractor in writing 72 hours prior to the proposed interruption. The Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay and shall restore service without delay in event of emergency.

1.6.6 Gas

Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off.

1.7 PHYSICAL DATA

The physical conditions indicated on the drawings and in the specifications are the result of soils investigations. See Section 01055 SOIL BORING DATA for boring logs and data.

1.8 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the Contract Clause entitled "Default: (Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

a. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

b. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

1.8.1 Schedule

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Langley AFB	9	9	9	6	7	6	7	7	5	6	7	9

1.8.2 Records

Upon acknowledgement of the Notice to Proceed and continuing throughout the contract, the contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day.

1.8.3 Impacted Days

The number of actual adverse weather days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day in each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in the schedule of monthly anticipated adverse weather delays, above, the contracting officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the Contract Clauses entitled "Default (Fixed Price Construction)".

1.9 SITE CONTAMINATION

This site is designated a Category I site and is defined as a site that is located in a traditional non-hazardous location, such as in an administrative, recreation, or housing area and that the Government has no reason to suspect contamination.

1.9.1 Compliance Requirements

The Contractor shall comply with applicable Federal, state and local laws, codes, ordinances and regulations (including the obtaining of licenses and permits) in connection with any hazardous material, substance or waste.

1.9.2 Requirements

The requirements of this clause and any act or failure to act by the

Government shall not relieve the Contractor of any responsibility or liability for the safety of Government, Contractor or subcontractor personnel or property.

1.9.3 Contamination

In the event that contamination beyond that shown or specified is encountered, the Contracting Officer shall be advised immediately. The contamination shall be removed as directed and replaced with satisfactory material. Payment therefor will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES.

1.10 HISTORICAL AND ARCHAEOLOGICAL FINDS

Federal legislation provides for the protection, preservation, and collection of scientific, prehistorical, historical, and archaeological data, including relics and specimens which might otherwise be lost due to alteration of the terrain or building features as a result of any Federal construction project. Should the Contractor, or any of the Contractor's employees, or parties operating or associated with the Contractor, in the performance of this contract discover evidence of possible scientific, prehistorical, historical, or archaeological data, the Contractor shall immediately cease work at that location and notify the Contracting Officer, giving the location and nature of the findings. The Contractor shall forward written confirmation to the Contracting Officer as directed. The Contractor shall exercise care so as not to disturb or damage artifacts or fossils uncovered during excavation operations, and shall provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition. Any person who, without permission, injures, destroys, excavates, appropriates, or removes any historical or prehistorical artifact, object of antiquity, or archaeological resource on the public lands of the United States is subject to arrest and penalty of law. Where appropriate by reason of discovery, the Contracting Officer may order delays in the time of performance or changes in the work, or both. If such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with the applicable clauses of the contract.

1.11 EQUIPMENT-IN-PLACE LIST:

The Contractor shall maintain a list of equipment installed under the terms of the contract. In the event that the contract includes more than one building or facility, a list must be maintained for each and delivered to the Contracting Officer upon acceptance of each building or facility. Forms to be used for this purpose are included in RMS, as described in Section 01312 RESIDENT MANAGEMENT SYSTEM (RMS). The list shall include the following:

a. Contract number
b. Description of item
c. Model number
d. Serial number
e. Capacity
f. Name of manufacturer
g. Address of manufacturer
h. Condition of item
i. Replacement cost
j. Name of person who checked item

1.12 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

1.12.1 Allowable Costs

Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a Contractor or subcontractor at any tier shall be based on actual cost data when the Government can determine both ownership and operating costs for each piece of equipment or equipment groups of similar serial and series from the Contractor's accounting records. When both ownership and operating costs cannot be determined from the Contractor's accounting records, equipment costs shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," Region II. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply.

1.12.2 Rental Costs

Equipment rental costs are allowable, subject to the applicable provisions of the Federal Acquisition Regulations, and shall be substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease-purchase or sale-leaseback arrangements will be determined using the schedule except that rental costs leased form an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees are allowable. Costs for major repairs and overhaul are unallowable.

1.12.3 Equipment Costs

When actual equipment costs are proposed and the total amount of the pricing action is over $25,000, cost or pricing data shall be submitted on the Standard Form 1411, "Contract Pricing Proposal Cover Sheet". By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorizing representative the right to examine those books, records, documents and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete and current.

1.12.4 Marine Equipment

In determining the ownership expense for marine equipment as described in the Schedule, the average use per year shall be 8 months.

1.13 SUBCONTRACTS AND WORK COORDINATION

Contract Clauses "SUBCONTRACTS", "PERMITS AND RESPONSIBILITIES", and "MATERIAL AND WORKMANSHIP" are supplemented as follows:

a. Divisions or sections of specifications are not intended to control the Contractor in dividing the work among subcontractors, or to limit work performed by any trade.

b. Contractor shall be responsible for coordination of the work of the trades, subcontractors, and materials.

c. The Government or its representative will not undertake to settle any difference between the Contractor and Contractor's subcontractors, or between subcontractors.

d. The Government reserves the right to refuse to permit employment on the work or require dismissal from the work of any subcontractor who, by reason of previous unsatisfactory work on Corps of Engineers projects, or for any other reason is considered by the Contracting Officer to be incompetent or otherwise objectionable.

1.14 CONSTRUCTION MANPOWER AND EQUIPMENT REPORT

The Contractor shall submit executed CENAO Form 987, Construction Manpower and Equipment Report daily. The report shall include manpower and equipment for the general and subcontractors. Forms are available from the Contracting Officer.

1.15 PURCHASE ORDERS

To ensure proper expediting of orders the Contractor and his subcontractors shall furnish to the Contracting Officer, one copy of each purchase order covering supplies or services required for performance of the work. Each purchase order shall clearly indicate the date of placement, the date delivery is required in order to avoid delay in the scheduled progress of the work, and the date delivery is promised by the supplier or producer. Copies of purchase orders shall be forwarded on the date issued.

1.16 PROFIT

1.16.1 Weighted Guidelines

Weighted guidelines method of determining profit shall be used on any equitable adjustment change order or modification issued under this contract. The profit factors shall be as follows:

Factor	Rate	Weight	Value
Degree of Risk	20		
Relative difficulty of work	15		
Size of Job	15		
Period of performance	15		
Contractor's investment	05		
Assistance by Government	05		
Subcontracting	25		
	100		

1.16.2 Value

Based on the circumstances of each procurement action, each of the above factors shall be weighted from .03 to .12 as indicated below. The value shall be obtained by multiplying the rate by the weight. The value column when totalled indicates the fair and reasonable profit percentage under the circumstances of the particular procurement.

1.16.2.1 Degree of Risk

Where the work involves no risk or the degree of risk is very small, the weighting should be .03; as the degree of risk increases, the weighting should be increased up to a maximum of .12. Lump sum items will have, generally, a higher weighted value than the unit price items for which quantities are provided. Other things to consider: the portion of the work to be done by subcontractors, nature of work, where work is to be performed, reasonableness of negotiated costs, amount of labor included in costs, and whether the negotiation is before or after performance of work.

1.16.2.2 Relative Difficulty of Work

It the work is most difficult and complex, the weighting should be .12 and should be proportionately reduced to .03 on the simplest of jobs. This factor is tied in to some extent with the degree of risk. Some things to consider: the nature of the work, by whom it is to be done, where, and what is the time schedule.

1.16.2.3 Size of Job

All work not in excess of $100,000 shall be weighted at .12. Work estimated between $100,000 and $5,000,000 shall be proportionately weighted from .12 to .05.

1.16.2.4 Periods of Performance

Jobs in excess of 24 months are to be weighted at .12. Jobs of lesser duration are to be proportionately weighted to a minimum of .03 for jobs not to exceed 30 days. No weight where additional time not required.

1.16.2.5 Contractor's Investment

To be weighted from .03 to .12 on the basis of below average, average, and above average. Things to consider: amount of subcontracting, mobilization payment item, Government furnished property, equipment and facilities, and expediting assistance.

1.16.2.6 Assistance by Government

To be weighted from .12 to .03 on the basis of average to above average. Things to consider: use of Government owned property, equipment and facilities, and expediting assistance.

1.16.2.7 Subcontracting

To be weighted inversely proportional to the amount of subcontracting. Where 80 percent or more of the work is to be subcontracted, the weighting is to be .03 and such weighting proportionately increased to .12 where all the work is performed by the Contractor's own forces.

1.17 PROJECT PHASING REQUIREMENTS

1.17.1 General Requirements - General Officer's Quarters

All work on all General Officer's Quarters shall be completed within 912 calendar days after the Contractor receives the Notice To Proceed. The Four Star General Officer's Quarters will be turned over to the Contractor at Notice To Proceed. At any given time during the construction duration period the Contractor will have no fewer than two and no more than six

General Officer's Quarters under construction. Both ~~units~~**quarters** in a duplex building will be turned over to the Contractor at the same time.

The Contractor will be given 14 days notification prior to a building becoming vacant and available for construction to commence. The Contractor shall provide the Contracting Officer a written notice seven calendar days prior to the completion of each Building.

1.17.2 General Requirements - Enlisted Quarters

All work on all Enlisted Quarters shall be completed within 730 calendar days after the Contractor receives the Notice To Proceed. At any given time during the construction duration period the Contractor will have no fewer than eight and no more than twelve Enlisted Quarters under construction. Both ~~units~~**quarters** in a duplex building will be turned over to the Contractor at the same time.

The Contractor will be given 14 days notification prior to a building becoming vacant and available for construction to commence. The Contractor shall provide the Contracting Officer a written notice seven calendar days prior to the completion of each Building.

1.17.3 Construction Duration for Individual Buildings

All work associated with the Four Star General Officer's Quarters Building 418 and each Single Family General Officer's Quarters Buildings 414 and 549, shall be completed within 240 calendar days after each building is turned over to the Contractor. All work associated with each Single Family General Officer's Quarters Buildings 417, 422, 424, 548 and 557 and each Duplex General Officer's Quarters Building 426, 429, 430 and 431, and each Duplex Enlisted Quarters Building shall be completed within 180 days after each building is turned over to the Contractor.

1.17.4 Unoccupied/Occupied Quarters

Each quarters where work is to be accomplished will not be occupied during the work. However, nearby adjacent quarters where work is not being accomplished will remain occupied. Therefore, the Contractor shall conduct his operations to cause the least possible inconvenience to the residents of the occupied quarters. Activities of the occupants in or near the scheduled work area shall not be interrupted or hampered in any way without prior written approval of the Contracting Officer. The Contractor's operations shall not cause any danger or safety hazard to the residents of the occupied quarters.

The re-roofing of Building 426 may begin prior to the remainder of the renovation of this building. If so, the building will remain occupied while it is re-roofed. The remainder of the renovation work will be turned over to the Contractor at a later time. The building will be unoccupied for the remainder of the renovation work.

1.17.5 Submittals, Notifications, and Daily Report

The Contractor shall coordinate all submittals and notifications as required by the Langley Air Force Base Housing Office of the scheduled work areas and furnish copies of all submittals and notifications to the Contracting Officer for approval prior to commencing the scheduled work activities. All activities of the Contractor shall be noted in the Daily Report of operations on the day of the activity.

1.18 HISTORICAL PAVING

Historical concrete paving, including driveways and sidewalks, is identified on the Civil drawings. The Contractor is prohibited from driving on historical paving. The Contractor is prohibited from using historical paving for laydown or storage areas. The historical paving shall not be damaged by the Contractor's operations in any way.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01850

CONTRACT DRAWINGS
03/98

NORFOLK DISTRICT

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LF 442 1.157 GOQ DUPLEX - TYPE B - BLDG 430 ATTIC FLOOR PLAN - NEW WORK

LF 442 1.158 GOQ DUPLEX - TYPES A & B FINISH AND DOOR SCHEDULES - NEW WORK

LF 442 1.159 GOQ DUPLEX - TYPE A - BLDGS 426, 429, 431 ROOF PLAN - DEMOLITION
LF 442 1.160 GOQ DUPLEX - TYPE A - BLDGS 426, 429, 431 ROOF PLAN - NEW WORK

LF 442 1.161 GOQ DUPLEX - TYPE B - BLDG 430 ROOF PLAN - DEMOLITION
LF 442 1.162 GOQ DUPLEX - TYPE B - BLDG 430 ROOF PLAN - NEW WORK

LF 442 1.163 GOQ DUPLEX - TYPE B - BLDGS 426,429,431 EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.164 GOQ DUPLEX - TYPE B - BLDGS 426,429,431 EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.165 GOQ DUPLEX - TYPE B - BLDGS 426,429,431 EXTERIOR ELEVATIONS - NEW WORK
LF 442 1.166 GOQ DUPLEX - TYPE B - BLDGS 426,429,431 EXTERIOR ELEVATIONS - NEW WORK

LF 442 1.167 GOQ DUPLEX - TYPE B - BLDG 430 EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.168 GOQ DUPLEX - TYPE B - BLDG 430 EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.169 GOQ DUPLEX - TYPE B - BLDG 430 EXTERIOR ELEVATIONS - NEW WORK
LF 442 1.170 GOQ DUPLEX - TYPE B - BLDG 430 EXTERIOR ELEVATIONS - NEW WORK

LF 442 1.171 GOQ DUPLEX - TYPES A & B BUILDING SECTIONS - NEW WORK
LF 442 1.172 GOQ DUPLEX - TYPES A & B BUILDING SECTIONS - NEW WORK
LF 442 1.173 GOQ DUPLEX - TYPES A & B WALL SECTIONS - DEMOLITION AND NEW WORK
LF 442 1.174 GOQ DUPLEX - TYPES A & B WALL SECTIONS - DEMOLITION AND NEW WORK
LF 442 1.175 GOQ DUPLEX - TYPES A & B ENLARGED PLAN AND INTERIOR ELEVATIONS - KITCHEN
LF 442 1.176 GOQ DUPLEX - TYPES A & B ENLARGED PLANS AND INTERIOR ELEVATIONS - BATH
LF 442 1.177 GOQ DUPLEX - TYPES A & B ENLARGED PLANS AND INTERIOR ELEVATIONS - BATH
LF 442 1.178 GOQ DUPLEX - TYPES A & B INTERIOR ELEVATIONS - LIVING ROOM
LF 442 1.179 GOQ DUPLEX - TYPES A & B CASEWORK SECTIONS AND DETAILS

LF 442 1.180 GOQ DUPLEX - TYPES A & B TRIM DETAILS
LF 442 1.181 GOQ DUPLEX - TYPES A & B DOOR DETAILS
LF 442 1.182 GOQ DUPLEX - TYPES A & B WINDOW ELEVATIONS AND DETAILS
LF 442 1.183 GOQ DUPLEX - TYPES A & B WINDOW DETAILS
LF 442 1.183A GOQ DUPLEX - TYPES A & B WINDOW DETAILS
LF 442 1.184 GOQ DUPLEX - TYPES A & B ROOF DETAILS
LF 442 1.185 GOQ DUPLEX - TYPES A & B ROOF DETAILS
LF 442 1.186 GOQ DUPLEX - TYPES A & B MISCELLANEOUS DETAILS

LF 442 1.187 GOQ DUPLEX - TYPES A & B PLUMBING LEGEND, NOTES AND DETAILS
LF 442 1.188 GOQ DUPLEX - TYPES A & B MECHANICAL LEGEND, NOTES AND DETAILS
LF 442 1.189 GOQ DUPLEX - TYPES A & B BASEMENT FLOOR PLAN - PLUMBING & MECHANICAL - DEMOLITION
LF 442 1.190 GOQ DUPLEX - TYPES A & B FIRST FLOOR PLAN - PLUMBING & MECHANICAL - DEMOLITION
LF 442 1.191 GOQ DUPLEX - TYPES A & B SECOND FLOOR PLAN - PLUMBING & MECHANICAL - DEMOLITION
LF 442 1.192 GOQ DUPLEX - TYPES A & B ATTIC FLOOR PLAN - PLUMBING & MECHANICAL - DEMOLITION
LF 442 1.193 GOQ DUPLEX - TYPES A & B BASEMENT FLOOR PLAN - PLUMBING - NEW WORK
LF 442 1.194 GOQ DUPLEX - TYPES A & B FIRST FLOOR PLAN - PLUMBING - NEW WORK
LF 442 1.195 GOQ DUPLEX - TYPES A & B SECOND FLOOR PLAN - PLUMBING - NEW WORK
LF 442 1.196 GOQ DUPLEX - TYPES A & B ATTIC FLOOR PLAN - PLUMBING - NEW WORK
LF 442 1.197 GOQ DUPLEX - TYPES A & B ISOMETRIC RISER DIAGRAMS
LF 442 1.198 GOQ DUPLEX - TYPES A & B BASEMENT FLOOR PLAN - MECHANICAL - NEW WORK
LF 442 1.199 GOQ DUPLEX - TYPES A & B FIRST FLOOR PLAN - MECHANICAL - NEW WORK
LF 442 1.200 GOQ DUPLEX - TYPES A & B SECOND FLOOR PLAN - MECHANICAL - NEW WORK
LF 442 1.201 GOQ DUPLEX - TYPES A & B ATTIC FLOOR PLAN - MECHANICAL - NEW WORK

LF 442 1.202 GOQ DUPLEX - BLDGS 426, 429, 430, 431 ELECTRICAL LEGEND AND NOTES
LF 442 1.203 GOQ DUPLEX - BLDGS 426, 429, 430, 431 BASEMENT PLAN - ELECTRICAL - DEMOLITION
LF 442 1.204 GOQ DUPLEX - BLDGS 426, 429, 430, 431 FIRST FLOOR PLAN - ELECTRICAL - DEMOLITION
LF 442 1.205 GOQ DUPLEX - BLDGS 426, 429, 430, 431 SECOND FLOOR PLAN - ELECTRICAL - DEMOLITION
LF 442 1.206 GOQ DUPLEX - BLDGS 426, 429, 430, 431 ATTIC PLAN - ELECTRICAL - DEMOLITION
LF 442 1.207 GOQ DUPLEX - BLDGS 426, 429, 430, 431 BASEMENT PLAN - ELECTRICAL - NEW WORK
LF 442 1.208 GOQ DUPLEX - BLDGS 426, 429, 430, 431 FIRST FLOOR PLAN - ELECTRICAL - NEW WORK
LF 442 1.209 GOQ DUPLEX - BLDGS 426, 429, 430, 431 SECOND FLOOR PLAN - ELECTRICAL - NEW WORK
LF 442 1.210 GOQ DUPLEX - BLDGS 426, 429, 430, 431 ATTIC PLAN - ELECTRICAL - NEW WORK
LF 442 1.211 GOQ DUPLEX - BLDGS 426, 429, 430, 431 ELECTRICAL WIRING DIAGRAMS
LF 442 1.212 GOQ DUPLEX - BLDGS 426, 429, 430, 431 FIXTURE SCHEDULE AND DETAILS

EQ - DUPLEX UNITS

LF 442 1.213 ENLISTED UNIT TYPES A, B, C & D COVER SHEET
LF 442 1.214 ENLISTED UNIT TYPES A, B, C & D INDEX OF DRAWINGS
LF 442 1.215 ENLISTED UNIT TYPES A, B, C & D LOCATION MAP

LF 442 1.216 ENLISTED UNIT TYPES A, B, C, D OVERALL SITE PLAN
LF 442 1.217 TYPICAL UNIT LAYOUT SITE PLAN

LF 442 1.218 ENLISTED BLDGS. 815 & 816 SITE PLAN
LF 442 1.219 ENLISTED BLDGS. 818 & 819 SITE PLAN
LF 442 1.220 ENLISTED BLDGS. 848 & 950 SITE PLAN
LF 442 1.221 ENLISTED BLDGS. 951 & 956 SITE PLAN
LF 442 1.222 ENLISTED BLDGS. 957 & 960 SITE PLAN
LF 442 1.223 ENLISTED BLDGS. 969 & 971 SITE PLAN
LF 442 1.224 ENLISTED BLDGS. 974 & 975 SITE PLAN
LF 442 1.225 ENLISTED BLDGS. 976 & 980 SITE PLAN
LF 442 1.226 ENLISTED BLDGS. 983 & 985 SITE PLAN
LF 442 1.227 ENLISTED BLDGS. 986 & 987 SITE PLAN
LF 442 1.228 ENLISTED BLDGS. 988 & 989 SITE PLAN
LF 442 1.229 ENLISTED BLDGS. 991 & 995 SITE PLAN

LF 442 1.230 ENLISTED BLDG. 997 SITE PLAN

LF 442 1.231 ENLISTED UNIT TYPES A, B, C & D STRUCTURAL NOTES AND ABBREVIATIONS LIST
LF 442 1.232 ENLISTED UNIT TYPES A, B, C & D PARTIAL FOUNDATION AND FIRST FLOOR FRAMING PLAN
LF 442 1.233 ENLISTED UNIT TYPES A, B, C & D ROOF FRAMING PLAN
LF 442 1.234 ENLISTED UNIT TYPES A, B, C & D SECTIONS
LF 442 1.235 ENLISTED UNIT TYPES A, B, C & D TYPICAL DETAILS

LF 442 1.236 ENLISTED UNIT TYPES A, B, C & D BID QUANTITIES SCHEDULE
LF 442 1.236A ENLISTED UNIT TYPES A, B, C & D GENERAL NOTES AND LEGENDS

LF 442 1.237 ENLISTED UNIT TYPE A BASEMENT PLAN - DEMOLITION
LF 442 1.238 ENLISTED UNIT TYPE A FIRST FLOOR PLAN - DEMOLITION
LF 442 1.239 ENLISTED UNIT TYPE A SECOND FLOOR PLAN - DEMOLITION
LF 442 1.240 ENLISTED UNIT TYPE B BASEMENT PLAN - DEMOLITION
LF 442 1.241 ENLISTED UNIT TYPE B FIRST FLOOR PLAN - DEMOLITION
LF 442 1.242 ENLISTED UNIT TYPE B SECOND FLOOR PLAN - DEMOLITION
LF 442 1.243 ENLISTED UNIT TYPE C BASEMENT PLAN - DEMOLITION
LF 442 1.244 ENLISTED UNIT TYPE C FIRST FLOOR PLAN - DEMOLITION
LF 442 1.245 ENLISTED UNIT TYPE C SECOND FLOOR PLAN - DEMOLITION
LF 442 1.246 ENLISTED UNIT TYPE D BASEMENT PLAN - DEMOLITION
LF 442 1.247 ENLISTED UNIT TYPE D FIRST FLOOR PLAN - DEMOLITION
LF 442 1.248 ENLISTED UNIT TYPE D SECOND FLOOR PLAN - DEMOLITION
LF 442 1.249 ENLISTED UNIT TYPE A BASEMENT PLAN - NEW WORK
LF 442 1.250 ENLISTED UNIT TYPE A FIRST FLOOR PLAN - NEW WORK
LF 442 1.251 ENLISTED UNIT TYPE A SECOND FLOOR PLAN - NEW WORK
LF 442 1.252 ENLISTED UNIT TYPE B BASEMENT PLAN - NEW WORK
LF 442 1.253 ENLISTED UNIT TYPE B FIRST FLOOR PLAN - NEW WORK
LF 442 1.254 ENLISTED UNIT TYPE B SECOND FLOOR PLAN - NEW WORK
LF 442 1.255 ENLISTED UNIT TYPE C BASEMENT PLAN - NEW WORK
LF 442 1.256 ENLISTED UNIT TYPE C FIRST FLOOR PLAN - NEW WORK
LF 442 1.257 ENLISTED UNIT TYPE C SECOND FLOOR PLAN - NEW WORK
LF 442 1.258 ENLISTED UNIT TYPE D BASEMENT PLAN - NEW WORK

LF 442 1.259 ENLISTED UNIT TYPE D FIRST FLOOR PLAN - NEW WORK
LF 442 1.260 ENLISTED UNIT TYPE D SECOND FLOOR PLAN - NEW WORK

LF 442 1.261 ENLISTED UNIT TYPES A, B, C & D FINISH AND DOOR SCHEDULES

LF 442 1.262 ENLISTED UNIT TYPE D ROOF PLAN
LF 442 1.263 ENLISTED UNIT TYPE A EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.264 ENLISTED UNIT TYPE A EXTERIOR ELEVATIONS - NEW WORK
LF 442 1.265 ENLISTED UNIT TYPE B EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.266 ENLISTED UNIT TYPE B EXTERIOR ELEVATIONS - NEW WORK

LF 442 1.267 ENLISTED UNIT TYPE A/B EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.268 ENLISTED UNIT TYPE A/B EXTERIOR ELEVATIONS - NEW WORK

LF 442 1.269 ENLISTED UNIT TYPE C EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.270 ENLISTED UNIT TYPE C EXTERIOR ELEVATIONS - NEW WORK
LF 442 1.271 ENLISTED UNIT TYPE D EXTERIOR ELEVATIONS - DEMOLITION
LF 442 1.272 ENLISTED UNIT TYPE D EXTERIOR ELEVATIONS - NEW WORK

LF 442 1.273 ENLISTED UNIT TYPES A, B, C & D BUILDING SECTIONS - NEW WORK
LF 442 1.274 ENLISTED UNIT TYPES A, B, C & D WALL SECTIONS AND PARTITION TYPES
LF 442 1.275 ENLISTED UNIT TYPES A, B, C & D WALL SECTIONS AND PARTITION TYPES
LF 442 1.276 ENLISTED UNIT TYPES A, B, C & D ENLARGED PLAN AND INTERIOR ELEVATIONS - KITCHEN
LF 442 1.277 ENLISTED UNIT TYPES A, B, C & D ENLARGED PLAN AND INT ELEVS - BATH & LAUNDRY
LF 442 1.278 ENLISTED UNIT TYPES A, B, C & D CASEWORK SECTIONS AND DETAILS
LF 442 1.279 ENLISTED UNIT TYPES A, B, C & D DOOR DETAILS
LF 442 1.280 ENLISTED UNIT TYPES A, B, C & D DOOR DETAILS
LF 442 1.281 ENLISTED UNIT TYPES A, B, C & D DOOR DETAILS
LF 442 1.282 ENLISTED UNIT TYPES A, B, C & D WINDOW ELEVATIONS AND DETAILS
LF 442 1.283 ENLISTED UNIT TYPES A, B, C & D WINDOW DETAILS
LF 442 1.284 ENLISTED UNIT TYPES A, B, C & D WINDOW DETAILS
LF 442 1.285 ENLISTED UNIT TYPES A, B, C & D ROOF DETAILS
LF 442 1.286 ENLISTED UNIT TYPES A, B, C & D ROOF DETAILS
LF 442 1.287 ENLISTED UNIT TYPES A, B, C & D TRIM AND MISCELLANEOUS DETAILS
LF 442 1.288 ENLISTED UNIT TYPES A, B, C & D STAIR SECTIONS AND DETAILS
LF 442 1.289 ENLISTED UNIT TYPES A, B, C & D SCREEN PORCH ELEVATIONS AND DETAILS
LF 442 1.290 ENLISTED UNIT TYPES A, B, C & D MISCELLANEOUS DETAILS AND PHOTOS
LF 442 1.291 ENLISTED UNIT TYPES A, B, C & D MISCELLANEOUS DETAILS

LF 442 1.292 ENLISTED UNIT TYPES A, B, C & D PLUMBING LEGEND, NOTES AND DETAILS
LF 442 1.293 ENLISTED UNIT TYPES A, B, C & D MECHANICAL LEGEND, NOTES AND DETAILS
LF 442 1.294 ENLISTED UNIT TYPES A, B, C & D BASEMENT PLANS- PLUMBING / MECHANICAL - DEMOLITION
LF 442 1.295 ENLISTED UNIT TYPES A, B, C & D SECOND FLOOR PLAN - PLUMBING / MECHANICAL - DEMOLITION

LF 442 1.296 ENLISTED UNIT TYPES A & B BASEMENT AND FIRST FLOOR PLANS - PLUMBING - NEW WORK
LF 442 1.297 ENLISTED UNIT TYPES A & B SECOND FLOOR PLAN - PLUMBING - NEW WORK
LF 442 1.298 ENLISTED UNIT TYPES C & D BASEMENT AND FIRST FLOOR PLANS -

		PLUMBING - NEW WORK
LF 442 1.299	ENLISTED UNIT TYPES C & D	SECOND FLOOR PLAN - PLUMBING - NEW WORK
LF 442 1.300	ENLISTED UNIT TYPES A, B, C & D	ISOMETRIC DIAGRAMS
LF 442 1.301	ENLISTED UNIT TYPES A, B, C & D	BASEMENT & FIRST FLOOR PLANS - MECHANICAL - NEW WORK
LF 442 1.302	ENLISTED UNIT TYPES A, B, C & D	SECOND FLOOR PLAN - MECHANICAL - NEW WORK
LF 442 1.303	ENLISTED - UNITS A, B, C, D	ELECTRICAL LEGEND AND NOTES
LF 442 1.304	ENLISTED - UNITS TYPES A, B, C, D	BASEMENT PLANS - ELECTRICAL - DEMOLITION
LF 442 1.305	ENLISTED - UNITS TYPES A, B	FIRST & SECOND FLOOR PLANS - ELECTRICAL - DEMOLITION
LF 442 1.306	ENLISTED - UNITS TYPES C & D	FIRST AND SECOND FLOOR PLANS - ELECTRICAL - DEMOLITION
LF 442 1.307	ENLISTED - UNIT TYPES A, B, C, D	BASEMENT PLANS - ELECTRICAL - NEW WORK
LF 442 1.308	ENLISTED UNIT TYPES A, B	FIRST AND SECOND FLOOR PLAN - ELECTRICAL - NEW WORK
LF 442 1.309	ENLISTED UNIT TYPES C & D	FIRST AND SECOND FLOOR PLAN - ELECTRICAL - NEW WORK
LF 442 1.310	ENLISTED - UNIT TYPES A, B, C, D	ELECTRICAL WIRING DIAGRAMS AND PANEL SCHEDULE
LF 442 1.311	ENLISTED - UNIT TYPES A, B, C, D	FIXTURE SCHEDULE

-- End of Section --

SECTION 05500A

MISCELLANEOUS METAL
04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1997) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-344	(Rev B) Lacquer, Clear Gloss, Exterior, Interior

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Miscellaneous Metal Items

Fence

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: Foundation vents and handrails.

SD-04 Samples

Foundation Vents

Samples of the following items: Foundation vents. Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water. All exterior items (items exposed to the weather) shall be hot-dip galvanized. In addition, the metal closure plates in the Basement shall be hot-dip galvanized.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have anodized finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 BASEMENT ACCESS DOORS AND FRAME

Doors and panels shall be flush type unless otherwise indicated. Frames for basement access doors shall be fabricated of not lighter than .090 inch thick steel with welded joints and finished with anchorage for securing into construction. Basement access doors shall be fabricated of not lighter than .090 inch thick steel, with stiffened edges, complete with attachments. Basement access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall be hot-dip galvanized steel. Doors shall be provided that are compatible with the existing character of the house.

2.2 FOUNDATION VENTS

Foundation vents shall be the same size as the masonry opening and shall be of cast iron flat vent style to match existing. Insect screen shall be provided at the back of the vent. All surfaces shall be primed with zinc chromate.

2.3 HANDRAILS

Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail or 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

2.3.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be structural tubing

conforming to ASTM A 500, Grade A or B of equivalent strength. Steel railings shall be 1-1/2 inch nominal size. Railings shall be hot-dip galvanized and shop painted. Pipe collars shall be hot-dip galvanized steel.

a. Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 6 inches long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

b. Removable sections, toe-boards, and brackets shall be provided as indicated.

2.4 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.5 SAFETY NOSING

Safety nosings shall be of cast aluminum with plain, abrasive surface. Nosing shall be 4 inches wide and terminating at not more than 4 inches from the ends of treads. Safety nosings shall be provided with anchors not less than 3/4 inch long. Integrally cast mushroom anchors are not acceptable.

2.6 FENCE

New fence shall match existing adjacent fence in size, color, and dimensions. Existing fence is similar to Estate Fence, Style A as manufactured by Monumental Iron Works, with standard post tops and pressed point picket tops. Pickets shall be 3/4 inch square by 18 gauge. Posts shall be 2 inches square by 14 gauge. U-channel rails shall be 1-3/8 inches by 1-1/2 inches by 11 gauge. Vertical pickets shall be secured to horizontal rails by industrial drive rivets. Horizontal rails shall be secured to vertical posts with manufacturer's standard rail brackets. Brackets shall be ball and socket design capable of 30 degrees swivel. Brackets shall fully encapsulate the end rails. Provide two horizontal rails, spaced approximately 36 inches apart. Total height of fence above grade shall be approximately 48 inches. Spacing of posts shall not exceed 8 feet. Fence shall be hot dip galvanized and receive powder polyester finish coating in black color. The coating shall be a 4-stage power wash pretreatment process which cleans and prepares the metal substrate to assure complete adhesion of the powder coated finish. Stage 1 shall be a clean and phosphate treat simultaneously to form an amorphous structure on the metal substrate for superior powder coating adhesion. Stage 2 shall be a thorough water rinse to prepare the phosphate-coated metal substrate for

the seal rinse. Stage 3 shall be a non-chromated seal to provide added corrosion protection and improved adhesion. Stage 4 shall be all metal surfaces to be baked dry prior to the application of the powder coating. All metal shall then receive a polyester resin based powder coated finish applied by the electrostatic spray process to a minimum thickness of 2.5 mils. The polyester resin finish shall be cured in a 450 degrees metal temperature for 20 minutes. Posts shall be anchored in concrete, size not less than 12 inches in diameter by 36 inches in depth.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.2.1 Installation of Steel Handrails

Installation shall be by means of pipe sleeves secured to existing concrete with expansion shields or bolts. Rail ends shall be secured by steel pipe flanges anchored by expansion shields and bolts.

-- End of Section --

SECTION 06200A

FINISH CARPENTRY
04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM D 3656	(1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM F 547	(1977; R 1995) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C9	(1997) Plywood - Preservative Treatment by Pressure Processes
AWPA M4	(1999) Standard for the Care of Preservative-Treated Wood Products
AWPA P5	(2000) Standards for Waterborne Preservatives

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(1999) Architectural Woodwork Quality Standards

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA RIS-01-SS	(1997) Standard Specifications for Grades of California Redwood Lumber

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(1997) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Specs	(1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17	(1996; Supples VII(A-E), VIII(A-C)) Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Grading Rules	(1999) Western Lumber Grading Rules 95

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6	(1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Finish Carpentry

Fence

Drawings showing fabricated items and special mill and woodwork items including stairs and railings. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-03 Product Data

Siding

Fence

Manufacturer's printed data, showing texture, density, catalog cuts, and installation instructions.

Wood Items and Trim

Manufacturer's printed data indicating the usage of engineered or recycled wood products, and environmentally safe preservatives.

SD-04 Samples

Siding
Moldings

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), by using recycled wood products and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer. Recyclable products shall conform to EPA requirements in accordance with Section 01670A RECYCLED / RECOVERED MATERIALS. Wood items and trim include, but are not limited to, the following items: door trim, window trim, exterior trim, screen for porches, crown molding, base board and plywood shelving, ledger boards, clothes rod, light valance, and access panels. Shoe molding is specified in Section 09640A WOOD STRIP FLOORING.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, wood structural panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Preservative Treatment

2.1.4.1 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 0.25 pcf intended for above ground use.

b. 0.4 pcf intended for ground contact and fresh water use.

2.1.4.2 Exterior Wood Molding and Millwork

Exterior wood molding and millwork shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.1.5 Trim

2.1.5.1 Wood

Fascias and trim, including exterior door and window casing, shall be species and grade listed in TABLE I at the end of this section. Sizes shall be as indicated. Metal corners may be furnished in lieu of wood cornerboards for horizontal siding; and if furnished, shall be galvanized steel and primed or aluminum and primed.

2.1.6 Moldings

Moldings shall be of the pattern indicated and shall be of a grade compatible with the finish specified.

2.1.7 Woodwork Items

2.1.7.1 Shelving

Shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA Grading Rules, 1 inch thick; or plywood, interior type, Grade A-B, 3/4 inch thick, any species group as indicated. Provide hardwood edge banding for plywood shelving.

2.1.8 Wood Siding

Wood siding shall be of the species and grades listed in TABLE I at the end of this section. Siding shall be horizontal plain lap type, 1 inch thick, 6 inches wide, maximum practicable lengths, smooth face.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

2.3 ITEMS SPECIFIED IN OTHER SECTIONS

Rough sawn timbers (on exterior adjacent to existing stucco) are specified in Section 06100A ROUGH CARPENTRY. Wood legs, one inch by 4 inches (on island counters in Kitchens of GOQs) are specified in Section 12320 KITCHEN CABINETS AND VANITY CABINETS.

2.4 INSECT SCREENING FOR PORCHES

Insect screening shall conform to ASTM D 3656, Class 2, 18 x 14 mesh, color grey.

2.5 SCREEN WIRE FOR PORCHES

Screen wire shall be provided for the lower sections on screened-in porches as indicated. The screen wire shall be provided in addition to the insect screening which shall be provided full height on the porches. The screen wire shall be 1/2 inch mesh, 19 gauge, welded at joints, hot-dip galvanized and shall comply with ASTM A 185.

2.6 WOOD PRIVACY FENCE

Wood privacy fence shall be six feet high, shadow-box design with vertical boards alternating on each side of the rails. Board and post style shall be dog-eared, similar to AFSCO Fence Supply Company, Inc. Posts and rails shall be pressure treated Southern Yellow pine. Boards shall be Northern White Cedar and shall be nominal size one inch by 4 inches. Provide three horizontal rails, doweled on the posts. The fence shall be painted as specified in Section 09900A, PAINTING, GENERAL. Posts shall be anchored in concrete, not less than 12 inches in diameter by 36 inches in depth. Spacing of posts shall not exceed six feet.

PART 3 EXECUTION

3.1 EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water. Joints of built-up items, in addition to nailing, shall be glued as necessary for weather-resistant construction. End joints in built-up members shall be well distributed. Joints in flat work shall be shouldered. Backs of wide-faced miters shall be held together with metal rings and glue. Flat members shall be in maximum practicable lengths. Cornices shall be braced, blocked, and rigidly anchored for support and protection of vertical joints.

3.2 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

3.3 FINISH STAIRWORK

Finish stairwork shall conform to AWI Qual Stds, Custom Grade for opaque finish. Stairwork shall be erected to form a strong, rigid structure without squeaks or vibrations. Railings shall be secured with concealed fasteners. Wall rails shall be supported on metal brackets spaced near ends and not over 5 feet on centers.

3.4 WOODWORK ITEMS

3.4.1 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 24 inches on center or as required to limit deflection to 1/4 inch between supports with a load of 35 lb per lineal foot. Adjustable shelf hardware **for flat shelving** shall be ~~steel standards, channel shaped, with 1 inch adjustment slots and brackets designed for attachment to standards~~ **type for drilled holes, steel, No. 345 by Knape & Vogt or approved equal. Adjustable shelf hardware for angled shelving shall be type for drilled holes, steel with securing screw hole, No. 346 by Knape & Vogt or approved equal**.

3.4.2 Clothes Hanger Rods

Rods shall be provided where indicated and in all closets having hook strips. Rods shall be hardwood 1-1/2 inches in diameter. Rods shall be set parallel with the front edges of the shelving, and shall be supported at each end by suitable sockets, and by intermediate brackets spaced at not more than 3 foot centers.

3.5 HORIZONTAL SIDING

End joints shall be made over framing members and be so alternated that at least two boards will be between joints o the same support. Shorter pieces shall be uniformly distributed throughout each area. Starter strips shall be provided as necessary to establish proper slant for siding. Ends of siding shall be predrilled if necessary to prevent splitting when nailed. Horizontal plain lap siding shall be overlapped and nailed into each support in accordance with approved recommendations of the siding manufacturer.

3.6 TABLES

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
NELMA Grading Rules					
	Eastern Cedar				X
	Eastern W. Pine				X
	Northern Pine				X
	Eastern Spruce			X	
	Balsam Fir		X		
CRA RIS-01-SS	Redwood		X		
SCMA Specs	Cypress			X	
WCLIB Std 17					
	Larch				X
	Hemlock Fir				X
	Mountain Hemlock				X
	Sitka Spruce				X
WWPA Grading Rules					
	Hemlock Fir		X		
	Mountain Hemlock				X
	Idaho White Pine	X			
	Lodgepole Pine		X		
	Ponderosa Pine		X		

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
	Sugar Pine		X		
	Englemann Spruce		X		
	Douglas Fir South		X		
	Subalpine Fir		X		

NOTE 1: Western Cedar under WCLIB Std 17 shall be Grade B; and under WWPA Grading Rules, Western Cedar shall be Grade A for trim.

NOTE 2: Exterior trim shall be any of the species listed above. Interior trim shall be Poplar and shall be one grade below highest grade of species for paint finish.

-- End of Section --

SECTION 09310A

CERAMIC TILE **AND NATURAL STONE**
07/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.3	**(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive**
ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A137.1	(1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 241	(1990) Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 373	(1988; R 1994) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 503	(1999) Marble Dimension Stone (Exterior)
ASTM C 615	**(1999) Standard Specification for Granite Dimension Stone**

ASTM C 648	(1998) Breaking Strength of Ceramic Tile
ASTM C 1026	(1987; R 1996) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1027	(1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C 1178/C 1178M	(1999) Glass Mat Water-Resistant Gypsum Backing Panel

MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual	(1991) Design Manual IV Dimensional Stone

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk	(1997) Handbook for Ceramic Tile Installation

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tile
Setting-Bed
Mortar and Grout
Marble
Granite
Traventino; **G**

Manufacturer's catalog data.

Tile
Mortar and Grout
Granite
Traventino; **G**

Manufacturers preprinted installation and cleaning instructions.

SD-04 Samples

Tile; G
Accessories
Marble Thresholds; G
Marble; G
Granite; **G**
Tranventino; **G**

Samples of sufficient size to show color range, pattern, type and joints.

SD-07 Certificates

Tile
Mortar and Grout
Granite
Travertino; **G**

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 50 degrees F and rising. Temperature shall be maintained above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

1.6 BRICK PAVERS AND MARBLE FLOOR PANELS

The scope of work in this section includes the installation of brick pavers in addition to all work in connection with ceramic tile. The brick pavers are specified in Section 04200A MASONRY. The concrete slab to receive the setting bed is specified in Section 03307A CONCRETE FOR MINOR STRUCTURES. Careful coordination is required with the work included in these other sections.

The scope of work further includes the provision of marble floor panels for the hearth where indicated.

PART 2 PRODUCTS

2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 90 lbs and 250 lbs for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.50 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum coefficient of friction of 0.60 wet and

dry in accordance with ASTM C 1028. Floor tile shall be Class III-Medium Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027for abrasion resistance as related to foot traffic. Floor tile shall be ~~size 8 inches by 8 inches in Toilets and 12 inches by 12 inches in Laundry Rooms and Mud Rooms~~**provided in various sizes. See the drawings for locations of different sizes and colors**. Provide decorative tile in backsplash where indicated.

2.1.1 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with matte glaze. Tile ~~shall be 4-1/4 x 4-1/4 inches.~~**is required in various sizes. See the drawings for locations of different sizes and colors.** Color**s** shall be as indicated.

2.1.2 Accessories

Accessories shall be the built-in type of the same materials and finish as the wall tile. Accessories shall be provided as follows:

a. Ceramic towel bar (CTB - 24). Numbers indicate the length of the towel bar in inches. See the drawings for various length indications.

b. Ceramic toilet tissue dispenser (CTTD).

c. Ceramic soap and grab bar combination (CSGR), surface mounted.

d. Ceramic toothbrush and tumbler holder (CTTH).

e. Ceramic soap holder (CSH).

f. Ceramic towel ring (CTR).

2.2 MORTAR BED

The mortar bed for installation of brick pavers and marble floor panels shall be in accordance with ANSI A108.1A. The bond coat shall be portland cement paste on a mortar bed that is still workable, or latex - portland cement mortar on a cured bed. The mortar bed bond coat shall be portland cement slurry.

2.3 WATER

Water shall be potable.

2.4 MORTAR AND GROUT

Mortar, grout, and adhesive shall conform to the following:

2.4.1 Dry-Set Portland Cement Mortar

ANSI A118.1.

2.4.2 Latex-Portland Cement Mortar

ANSI A118.4.

2.4.3 Ceramic Tile Grout

ANSI A118.6; latex-portland cement grout.

2.5 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by MIA Design Manual. Marble shall have a fine sand-rubbed finish and shall be white in color as approved by the Contracting Officer. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241.

2.6 MARBLE FLOOR PANELS

Provide marble floor panels for hearth in Quarters number 554 as indicated. Panels shall be not less than one inch thick and shall have a smooth, honed finish. Panels shall meet or exceed the following physical properties when tested in accordance with ASTM C 503:

Absorption by weight, maximum of 0.09 percent.

Density, minimum 169 pounds per cubic foot.

Compressive strength, minimum 9,333 pounds per square inch.

Abrasive resistance, minimum, hardness 16.6.

Modulus of rupture, minimum 1364 pounds per square inch.

Flexural strength, minimum 1296 pounds per square inch.

Coefficient of friction .68.

2.7 COATED GLASS MAT BACKER BOARD

Coated glass mat backer board shall comply with ASTM C 1178/C 1178M. Thickness shall be 1/2 inch.

2.8 NATURAL STONE (GRANITE AND TRAVENTINO)

Provide natural stone for countertops where indicated. Granite shall comply with ASTM C 615 and shall be uniform and fine-grained without veining. Granite variety shall be Tan Brown as supplied by Dernis International. Finish shall be polished. Thickness of granite shall be not less than 1-1/4 inch. Edges shall be square, slightly eased, or rounded (pencil edges). Thickness of traventino shall be not less than 3/4 inch.

Adhesives, sealants, and grouts for use with natural stone shall be as recommended by the granite manufacturer. Seam adhesive shall be 2 part, epoxy-resin or polyester-resin stone adhesive with an initial set time of not more than two hours at 70 degrees F (21 degrees C). Color shall match the stone. Color of sealants shall be clear. Color of grouts shall match the stone. Sand-portland cement grout shall comply with ANSI A108.10. Dry-set grout (unsanded) shall comply with ANSI A118.6 for materials described in paragraph H-2.3 for joints 1/8 inch (3 mm) or narrower. Water-cleanable epoxy adhesive shall comply with ANSI A118.3.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Latex portland cement mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA Hdbk, method W244-2000.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar

Dry-set or Latex-portland cement shall be used to install tile in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA Hdbk, method F146-2000.

3.4.1 Dry-Set and Latex-Portland Cement

Dry-set or Latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4.2 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.10.

3.5 INSTALLATION OF BRICK PAVERS AND MARBLE FLOOR PANELS

Brick pavers and marble floor panels shall be installed in accordance with TCA Hdbk, method F101-99. Installation type shall be cement mortar, bonded. Brick pavers shall be laid in a basketweave pattern. The concrete slab is specified in Section 03307A CONCRETE FOR MINOR STRUCTURES. The

brick pavers are specified in Section 04200A MASONRY. The existing concrete slab (to receive the marble floor panels) shall be cleaned and roughened prior to provision of the setting bed.

3.6 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 1/4 inch in width and shall be grouted full as specified for ceramic tile.

3.7 EXPANSION JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07900AJOINT SEALING.

3.7.1 Walls

Expansion joints shall be provided at control joints in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

3.7.2 Floors

Expansion joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Expansion joints shall be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

3.8 NATURAL STONE

3.8.1 Installation of Countertops

Install countertops with full spread of water-cleanable epoxy adhesive. Install countertops by adhering to supports with water-cleanable epoxy adhesive. Bond seams with stone seam adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to seams to prevent adhesive smears. Clamp units to temporary bracing to ensure that countertops are properly aligned and seams are minimum width. Space seams with 1/16-inch gap for filling with sealant. Use temporary shims to ensure uniform spacing and clamp units to temporary bracing to eliminate lipping.

3.8.2 Adjusting and Cleaning

Remove and replace stone of the following description:

a. Broken, chipped, stained, or otherwise damaged.

b. Defective countertops, including those with misaligned seams.

c. Defective joints and seams.

d. Interior facing and joints not matching approved samples.

e. Interior facing not complying with other requirements indicated.

Replace in a manner that results in interior stone facings matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement. For in-progress cleaning, clean interior stone as work progresses. Remove mortar and grout smears before tooling joints. Clean interior stone not less than six days after completion of grouting and pointing, using clean water and soft rags or stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.

3.9 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

SECTION 09562

REPAIR AND REFURBISHMENT OF WOOD STRIP FLOORING
11/99

PART 1 GENERAL

1.1 DESCRIPTION

Work included under this section includes the repair of existing wood strip flooring and preparation of strip floor for refinishing under Section 09900 PAINTING, GENERAL. Existing wood floors have been repeatedly sanded and refinished over the past years leaving only a thin layer of wood coverage over tongue and groove joints typically throughout several family housing units. Work specified herein addresses the techniques to be used in stripping the existing wood floor finish with minimal loss of wood joint coverage. Additionally, repair to existing floors is specified herein addressing the patching of floors damaged by other work under this contract as well as replacement of any existing cracked, split, defaced, or otherwise damaged wood floor members.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATIONS

FS TT-F-336E (Rev E) Filler, Wood, Paste (1978)

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Refurbishment; G.

The Contractor shall submit a general work plan describing the techniques of wood floor repair and refurbishment. The plan shall demonstrate the intended course of coordination with work of other trades. The Contractor shall submit a specific work plan for each family housing unit which identifies the extent of wood strip flooring and location of necessary repairs as required herein.

SD-03 Product Data

Operating Instructions

Submit manufacturer's data for equipment to be used in stripping floors including sanders and all operating instructions.

SD-07 Certificates

Restorer Qualifications; G.

Submit wood floor restorer's qualifications and credentials to perform the work herein specified. Demonstrate at least five years of experience in wood floor restoration and successful completion of at least three wood floor restorations in historic homes built not before 1930.

1.4 INSPECTION

The Contractor and wood floor restorer shall conduct a thorough inspection of each family housing unit immediately prior to commencement of wood floor restoration in order to survey the condition of wood strip flooring throughout the quarters. The extent of wood coverage over existing tongue and groove joints shall be examined to familiarize quality control personnel with the limitations on sanding depth. Locations of damaged wood floor members shall be identified for patching or replacement. Inquiries, interpretations, or questions of degree regarding floor repair and sanding should be addressed to the Contracting Officer prior to commencement of work.

1.5 DELIVERY AND STORAGE

Materials to be used in patching of wood strip flooring shall be delivered to the site and stored indoors under protective cover in well ventilated areas and protected from extreme changes in temperature and humidity. Temperature and humidity in the storage area shall closely approximate the temperature and humidity of the rooms in which the flooring is to be installed.

1.6 ENVIRONMENTAL CONDITIONS

Rooms where wood flooring is to be patched or replaced shall have adequate arrangements for ventilation and temperature controls. The temperature shall be maintained at 65 to 80 degrees F starting not less than three days prior to beginning of the installation of flooring and continuing throughout the remainder of the contract period.

1.7 SCHEDULING

Strip flooring work shall be scheduled after any work which would raise the moisture content of the flooring or damage the finished surface of the flooring.

PART 2 PRODUCTS

2.1 STRIP FLOORING

Strip flooring used for repair and replacement shall be oak, NHLA RMIHC to match existing wood flooring and shall be provided new. (The Contractor shall verify species of existing wood floor to assure new floor is same species at existing floor.) Wood strips shall be sized in width and depth to match existing wood flooring. Alternate species may be submitted for use if grain and finish color can be demonstrated to match existing flooring sufficiently.

2.2 NAILS

Nails shall be in accordance with strip flooring industry norms. Nails shall be self-clinching, L-shaped cleats designed for use in mallet-driven nailing device. As an alternative, case hardened cot nails, designed for wood floors may be used. Nailing device shall be hand-held and permit driving of nails at a 45 degree angle above the strip tongue. Surface nail devices will be permitted for installation of wood strip pieces where tongue cannot be exposed. Surface nailing shall be performed with self-clinching finish nails. Set surface nails and fill holes with wood putty prior to refinishing. Wood putty shall comply with FS TT-F-336E. Use colored putty to match finished flooring.

2.3 SANDING DEVICES

Heavy duty drum-type sanders with built-in vacuum for dust collection and automatic drum pressure control shall be used for area sanding. Reciprocating hand-held sanders with attached dust collection bags shall be used for edge sanding. Circular-motion sanders may be used only for final buffing with a pad or screen of No. 2 steel wool.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Surfaces to be repaired and restored shall be clean, dry and approved prior to start of work. Existing exposed nail heads shall be set and filled with wood putty matching the color of existing wood strip flooring. Prior to commencement of sanding, seal all wall, floor and ceiling openings, duct penetrations, diffusers, air returns, light fixtures with 6-mil poly plastic sheeting and tape to prevent the spread of wood dust into these items.

3.2 REPAIR OF WOOD STRIP FLOORING

Repair wood strip flooring prior to preparing for refinishing. Carefully remove damaged pieces of wood flooring with as little damage and removal of adjacent pieces as possible. Strip in new replacement pieces after pre-sanding replacement pieces to approximate depth required to match existing strip flooring thickness. Each strip shall be laid with close joints, snugly driven up or set down providing for absorption of a small amount of expansion. Alternate end joints in random pattern matching existing strip layout.

3.3 PREPARATION FOR REFINISHING

Except where existing wood coverage is 1/16 inch or less over tongue and groove joints, sand all wood strip flooring using a drum-type sander for two passes; the first with 80 grit sandpaper, the second using 100 grit or finer sandpaper. Both passes shall be in the same direction, parallel to the direction of the grain of strip flooring. Edge sanding shall be performed in a similar fashion using a hand-held reciprocating sander. A third, final pass shall be made over all areas using a circular-motion sander equipped with a buffing pad or screen of No. 2 steel wool. Areas not accessible to hand-held reciprocating sanders shall be sanded by hand. Sand to a smooth, even uniform finish without burns. Sand replacement pieces to identical thickness as adjacent existing wood strips. Remove a minimal thickness of existing wood surface up to 1/64 inch and in no case exceeding 1/32 inch. Where existing wood strip flooring has 1/16 inch or less coverage over tongue and groove joints, rub floors by hand with a

cloth and commercially-available varnish remover such as Varsol, allow to dry, and make a single pass with a circular sander equipped with a buffing screen. Remove as much existing floor finish as possible while retaining uniform floor color and texture. The final buffing shall be performed at a time and manner permitting prompt clean up and application of first seal coat. The flooring shall be left clean and ready to receive the finishing materials. Vacuum all floors, walls, sills and other surfaces where dust from sanding may have settled prior to application of finishing materials. Handle machinery, vacuums, and dust collection devices carefully while emptying to avoid the spread of wood dust. Collect and store dust in sealed bags and thoroughly vacuum all areas where dust is handled and stored. Personnel operating sanding equipment shall wear protective eye cover and breathing mask over mouth and nose while operating equipment and performing cleanup operations to prevent ingestion of wood dust. Dispose of wood dust in sealed containers off Government property.

3.4 SEALING AND VARNISHING

Apply sealer and varnish as specified in Section 09900 PAINTING, GENERAL. Allow coats to dry thoroughly before application of next coat. Lightly buff floors with No. 2 steel wool after the first coat of varnish has thoroughly dried. Maintain environmental conditions as specified herein throughout the sealing and varnishing process. Maintain color and texture continuity throughout all areas in each family housing unit. Refinish any areas not consistent with color and texture as required for continuity among adjacent surfaces.

3.5 PROTECTION AND FINAL CLEANING

Protect all wood strip flooring from the time of commencing wood floor restoration until final acceptance by the Government. Apply kraft paper as necessary over walking paths and surfaces. Remove all temporary protective surfaces measures including plastic sheeting kraft paper and tape. Clean all surfaces thoroughly with a soft cloth or dry mop prior to final inspection.

-- End of Section --

SECTION 10300

GAS LOGS
01/00

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Gas Logs

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Provide pictures of the gas logs.

1.2 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GAS LOGS

Gas logs shall be provided in existing fireplaces where indicated. Gas logs shall be the vent-free type and shall be single burner. Size shall be 22 inches width by 11 inches depth. Maximum BTU per hour input shall be 40,000. Gas logs shall be manually operated. Gas log operation shall not require electricity. Gas logs shall be equipped with oxygen depletion sensor (ODS) for safety operation. Style shall be split oak. Provide piezo-ignitor for easy pilot lighting. Logs shall be ceramic-bonded, steel-reinforced, refractory type for superior reproduction of bark detail and long life. Log set shall include a bag of volcanic ash.

PART 3 EXECUTION

3.1 INSTALLATION

All installation and set-up of gas log sets shall be in accordance with manufacturer's instructions and recommendations. The Contractor shall take

complete measurements of the existing fireplaces to verify that the gas logs are suitable size for the existing fireplaces.

-- End of Section --

SECTION 10800A

TOILET ACCESSORIES
04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991; R 1997) Flat Glass

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1994) Safety Glazing Materials Used in Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes
Accessory Items
Frameless Shower Enclosure

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Finishes; G
Accessory Items; G

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Porcelain type, tile-wall accessories are specified in Section 09310A CERAMIC TILE. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall have oval heads and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Medicine Cabinet (MC)

Medicine cabinet shall be constructed with cold-rolled carbon steel sheet of not less than .03 inch thick, formed from a single sheet of steel or shall have mechanically formed spot welded or any other suitable joints. Width, height and depth of cabinet shall be in accordance with paragraph SCHEDULE.

2.2.1.1 Swinging Door Cabinet, Class 2

Swinging door cabinet assembly including the lighting arrangement shall be as indicated. Assembly shall be recess mounted. Cabinet shall be located centrally behind the door and shall contain a minimum of two shelves. Door hinges shall be stainless steel or carbon steel. Magnets used in door catches shall be permanent type. Doors shall be with a mirror.

2.2.2 Mirrors, Glass (MG)

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. Glass shall

be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.2.1 Mirror Accessories

a. Mirror Frames: Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 1-1/4 x 1/4 inch continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

b. Mirror Clips: Concealed fasteners of type to suit wall construction material shall be provided with clips.

2.2.3 Towel Bar (MTB)

Towel bar shall have a minimum wall thickness of .015 inch. Bar shall be minimum 3/4 inch diameter, or 5/8 inch square. Style of towel bars shall be Taymor, Bellissima Collection, white porcelain base with chrome accents or approved equal.

2.2.4 Toilet Tissue Dispenser (MTTD)

Toilet tissue holder shall be Type II - surface mounted with one roll of standard tissue. Style and material of toilet tissue dispensers shall be Taymor, Bellissima Collection, white porcelain base with chrome accents or approved equal.

2.2.5 Towel Ring (MTR)

Towel ring shall be Taymor, Bellissima Collection, white porcelain base with chrome accents or approved equal.

2.2.6 Bypass Bath and Shower Door (BSD)

Bypass bath and shower door shall be width as required by width of bathtub. Height of door shall be approximately 56 inches. Glass shall be frosted tempered, not less than 1/4 inch thick. Frame components shall be extruded aluminum with bright silver finish. Door shall be Kohler Focal Bypass Bath and Shower Door number K7010 or approved equal.

2.3 FRAMELESS SHOWER ENCLOSURE

Glass shall be 3/8 inch thick, clear, tempered safety glazing, conforming to ANSI Z97.1. Framing members and hardware shall be polished, solid brass. Provide continuous brass tracks at top and bottom of glass and where glass abuts walls or partitions. Brass tracks shall not be provided at vertical joints between glass panels. Provide mitered glass at vertical

joints between glass panels. Provide complete door hardware including back to back "C" handles, 8 inches high by 3/4 inch diameter and deluxe pivot hinges. All hardware shall be supplied with bushings, gaskets, washers, and brass screws as necessary or recommended for a complete installation. All joints shall be waterproof. Sealant shall be clear silicone as recommended by the manufacturer of the enclosure. Enclosure manufactured by Century Shower Door, Inc., Glasstec, complies with these specifications.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance. Mirror shall not be glued to the wall. **Frameless enclosures shall be installed in a true workmanlike manner, making all final adjustments.**

3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

-- End of Section --

SECTION 15400

PLUMBING, GENERAL PURPOSE
08/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1	(1993; Z21.10.1a; Z21.10.1b; Z21.10.1c) Gas Water Heaters Vol. I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
ANSI Z21.10.3	(1998) Gas Water Heaters Vol. III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters
ANSI Z21.22	(1986; Z21.22a) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 733	(1999) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 888	(1998el) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 32	(1996) Solder Metal
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 88	(1999) Seamless Copper Water Tube

ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM B 306	(1999) Copper Drainage Tube (DWV)
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2235	(1996a) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2661	(1997ael) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(1998) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3138	(1995) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(1997) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(1997) Solvent Cements for Chlorinated

	Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(1999el) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F 891	(1998el) Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core
ASTM F 1760	(1997) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastuc Pipe Having Reprocessed-Recycled Content

ASME INTERNATIONAL (ASME)

ASME A112.14.1	(1975; R 1998) Backwater Valves
ASME A112.18.1M	(1996) Plumbing Fixture Fittings
ASME A112.19.1M	(1994; R 1999) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1998) Vitreous China Plumbing Fixtures
ASME A112.19.3M	(1987; R 1996) Stainless Steel Plumbing Fixtures (Designed for Residential Use)
ASME A112.19.4M	(1994; Errata Nov 1996) Porcelain Enameled Formed Steel Plumbing Fixtures
ASME A112.36.2M	(1991; R 1998) Cleanouts
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.12	(1998) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(1992; Errata Jan 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(1991; R 1998) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900,

	1500, and 2500, and Flanged Fittings, Class 150 and 300
ASME B16.29	(1994) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B31.5	(1992; B31.5a1994) Refrigeration Piping

AMERICAN SOCIETY OF SANITARY ENGINEERING FOR PLUMBING AND SANITARY RESEARCH(ASSE)

ASSE 1001	(1990) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1002	(1986) Water Closet Flush Tank Ball Cocks
ASSE 1003	(1995) Water Pressure Reducing Valves for Domestic Water Supply Systems
ASSE 1005	(1986) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size
ASSE 1011	(1995) Hose Connection Vacuum Breakers
ASSE 1012	(1995) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1993) Reduced Pressure Principle Backflow Preventers

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA EWW	(1999) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1999) Hypochlorites
AWWA B301	(1992; Addenda B301a - 1999) Liquid Chlorine
AWWA C105	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C203	(1997; addenda C203a - 1999) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(1997) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

CISPI HSN-85 (1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-240 (Rev A; Canc. Notice 1) Shower Head, Ball Joint

CID A-A-50012 (Basic) Garbage Disposal Machine, Commercial

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA Tube Handbook (1995) Copper Tube Handbook

COUNCIL OF AMERICAN BUILDING OFFICIALS (CABO)

CABO A117.1 (1998) Accessible and Usable Buildings and Facilities

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-01 (1993) Manual of Cross-Connection Control

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANCIAL OFFICIALS (IAPMO)

IAPMO Z124.5 (1997) Plastic Toilet (Water Closets) Seats

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58 (1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports - Selection and Application

MSS SP-73 (1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check Valves

MSS SP-110 (1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC Plumbing Code (1996) National Standard Plumbing Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1999) National Fuel Gas Code
NFPA 90A	(1996) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 14	(1999) Plastics Piping Components and Related Materials

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01	(1998) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J 1508	(1997) Hose Clamps

1.2 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.3 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System;

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be

supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-03 Product Data

Plumbing Fixture Schedule; G_____, __ED___.

Catalog cuts of specified plumbing fixtures valves and related piping.

Plumbing System; .

Diagrams, instructions, and other sheets proposed for posting.

SD-06 Test Reports

Tests, Flushing and Disinfection; G, RE.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-07 Certificates

Materials and Equipment;

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

SD-10 Operation and Maintenance Data

Plumbing System;

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.5 REGULATORY REQUIREMENTS

Plumbing work shall be in accordance with NAPHCC Plumbing Code.

1.6 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify

dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. Hubless cast-iron soil pipe shall not be installed underground or under concrete floor slabs. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74, AWWA C606.

b. Coupling for Steel Pipe: AWWA C606.

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21.

e. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN-85.

h. Solder Material: Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

i. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.

j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.

k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type): ASTM C 564.

l. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 230 degrees F.

m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.

o. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.

p. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.

q. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

r. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201.

b. Copper, Sheet and Strip for Building Construction: ASTM B 370.

c. Asphalt Roof Cement: ASTM D 2822.

d. Hose Clamps: SAE J 1508.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines:

AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves shall be gate valves unless otherwise indicated. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Pressure ratings shall be based upon the application. Valves used for water service shall have the Zinc content limited to no more than 6 percent for the stem, body, bonnet, wedge or disk in contact with the fluid. Valves shall conform to the following standards:

Description	Standard
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80

Description	Standard
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ASSE 1001
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22

2.3.1 Freeze Proof Wall Faucet/Hose Bibbs

Wall faucets/Hose Bibbs with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem. Wall Faucet/Hose Bibbs shall be designed such that the operating valve is located within the conditioned space.

2.3.2 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with NAPHCC Plumbing Code. Fixtures for use by the physically handicapped shall be in accordance with CABO A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years.

Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE attached at the end of this section of the specifications.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR-01. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011.

2.6 TRAPS

Each trap shall be placed as near the fixtures as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage or brass-tube type. Traps for floor drains or hub drains in mechanical rooms shall be of the deep seal design.

2.7 WATER HEATERS

Water heater types and capacities shall be as indicated.

2.7.1 Automatic Storage Type

Heaters shall be complete with control system and shall have ASME rated combination pressure and temperature relief valve.

2.7.1.1 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.1 when input is 75,000 BTU per hour or less or ANSI Z21.10.3 for heaters with input greater than 75,000 BTU per hour.

2.8 PUMPS

2.8.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The pumps shall be direct-connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Motors shall be totally enclosed, fan-cooled of sizes as indicated and shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosed, across-the-line, magnetic controller. Each pump shall be fitted with a high-grade thrust bearing mounted above the floor. Each shaft shall have an alignment bearing at each end, and the suction inlet shall be between 3 and 6 inches above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a NEMA 250, Type 1 enclosure, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump if the flow exceeds the

capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve or full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches. All exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific excepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and gate valve ahead of hose bibb.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Unions

Unions shall not be concealed in walls, ceilings, or partitions. Unions

shall be used on pipe sizes 2-1/2 inches and smaller.

3.1.2.3 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.4 Copper Tube and Pipe

The tube or fittings shall not be annealed when making connections. Connections shall be made with a multiflame torch.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA Tube Handbook.

c. Copper Tube Extracted Joint. An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC Plumbing Code using B-Cup series filler metal in accordance with MSS SP-73. Soldered extracted joints will not be permitted.

3.1.2.5 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.2.6 Other Joint Methods

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.4.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and

sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated in Section 07900 JOINT SEALING. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides.

3.1.4.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.4.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by

forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.4.4 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07900 JOINT SEALING.

3.1.5 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.1.6 Supports

3.1.6.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.6.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be

used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 4 inches.

(3) Have a high density insert for pipe 2 inches and larger and for smaller pipe sizes when the insulation is suspected of being visibly compressed, or distorted at or near the shield/insulation interface. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

l. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

m. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be

continuous through the hanger on all pipe sizes and applications.

n. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

3.1.7 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks and on each building drain outside the building. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron or plastic.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No other valves shall be installed between the relief valve and the water heater. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. The relief valve shall be installed directly in a tapping in the heater. A discharge pipe the full size of the relief valve outlet shall be connected to the valve outlet and terminated to the nearest floor drain.

3.2.2 Installation of Gas-Fired Water Heater

Installation shall conform to NFPA 54 for gas fired water heaters.

3.2.3 Heat Traps

Hot water supply piping to and from each water heater tank shall be routed horizontally and downward a minimum of 2 feet before turning in an upward direction.

3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric

unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Height of Fixture Rims Above Floor

Installation of fixtures for use by the physically handicapped shall be in accordance with CABO A117.1.

3.3.3 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.4 Fixture Supports

Fixture supports shall be designed and installed in accordance with the manufacturer's recommendations.3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with NAPHCC Plumbing Code at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.3.7 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311.

3.4 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in mechanical rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.5 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTING, GENERAL.

3.6 TESTS, FLUSHING AND DISINFECTION

3.6.1 Plumbing System

The plumbing system shall be tested in accordance with NAPHCC Plumbing Code.

3.6.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.6.3 System Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and

automatic control systems shall be adjusted for proper operation.

3.6.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve and faucet.

f. Temperature of each domestic hot-water supply.

g. Operation of each floor drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

3.6.5 Sterilization

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be sterilized. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence

of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.7 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic. The maximum water use shall be 1.6 gallons per flush.

Gasket shall be wax type.

Seat - IAPMO Z124.5, Type A, white plastic, closed front, residential style.

Flush Tank - An adequate quantity of water shall be provided to flush and clean the fixture served. The water supply to flush tanks equipped for manual flushing shall be controlled by a float valve or other automatic device designed to refill the tank after each discharge, and to completely shut off the water flow to the tank when the tank is filled to operational capacity. Water closets having their flush valve seat located below the flood level rim of the closet bowl shall have a ballcock installed within a sheath or in a separate and isolated compartment of the tank, both to have visible discharge onto the floor in case of failure. Provision shall be made to automatically supply water to the fixture so as to refill the trap seal after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled by a suitable timing device. Ballcocks shall meet ASSE 1002.

Flush Valve in Flush Tank - Flush valve seats in tanks for flushing water closets shall be at least 1 inch above the flood level rim of the bowl connected thereto, except in approved water closet and flush tank combinations designed so that when the tank is flushed and the fixture is clogged or partially clogged, the flush valve shall close tightly so that water will not spill continuously over the rim of the bowl or back flow from the bowl to the tank.

Fixture Design - All water closets shall be white in color.

Water closets shall be elongated bowl in all full baths and round bowl in the 1/2 baths. These water closets shall be American Standard "Colony" or approved equal in quality, performance, style and appearance.

P-2 GOQ 1/2 BATH LAVATORY:

Manufacturer's standard sink depth, oval, and shall be integral with the vanity tops as specified in Section 06650, SOLID POLYMER(SOLID SURFACING)FABRICATIONS.

Faucet - Faucets shall be dual control, mixing type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi. Faucet shall be polished chrome finish and shall be Delta 3577-LHP, or approved equal in

quality, performance, style and appearance.

Handles - Lever type. Finish shall be chrome base with porcelain handles. Faucet handles shall be Delta H22-A22PR, or approved equal in quality, performance, style and appearance.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

P-3 LAVATORY:

Manufacturer's standard sink depth, oval, and shall be integral with the vanity tops as specified in Section 06650, SOLID POLYMER(SOLID SURFACING)FABRICATIONS.

GOQ Unit Faucets - Faucets shall be dual control, mixing type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.For GOQ Master Bathroom faucets shall be Detla 3577-LHP or approved equal in quality, performance, style and appearance. For GOQ Hall Full baths and attic bath (Bldg 417 only) faucet shall be Delta 2521-LHP or approved equal in quality, performance, style and appearance. Finish shall be polished chrome.

Enlisted Quarters Faucet - Faucets shall be single control, mixing type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.Faucet shall be Delta 520-WFMPU, polished chrome, or approved equal in quality, performance, style and appearance.

Handles - Lever type. Cast, formed, or drop forged copper alloy. For GOQ Units the handles shall be Delta H22-A22PR, or approved equal in quality, performance, style and appearance.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

P-4 BAR SINK:

Countertop 19 inches x 16 inches enameled cast iron ASME A112.19.1M Color shall be white. Drain shall be stainless steel. Sink shall be Kohler "Apertif" K-6560-2, or approved equal in quality, performance, style and appearance.

Faucet and Spout - Cast or wrought copper alloy, gooseneck type with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Strainers shall have internal threads. Faucet

shall be Kohler 2172-LHP, or approved equal in quality, performance, style and appearance.

Handles - Cast copper alloy, wrought copper alloy, or stainless steel, lever type. Handles shall be Kohler H22-A22PR, chrome with porcelain handles, or approved equal in quality, performance, style and appearance.

P-5 KITCHEN SINK:

Self rimming with holes for faucet and spout and sprayer, double equal bowls 33 x 22 inches enameled cast iron ASME A112.19.1M in the GOQ units and stainless steel ASME A112.19.3M in the Enlisted Quarters. Sink for the GOQ Units shall be Kohler "Brookfieled" K-5942-4, white, or approved equal in quality, performance, style and appearance. Sink for the Enlisted Quarters shall be Kohler "Toccata", K-3346-4, or approved equal in quality, performance, style and appearance.

Faucet and Spout - Cast or wrought copper alloy. Aerator shall have internal threads. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing water pressure of 80 psi. Faucet shall include a handspray. For GOQ Units faucet shall be Kohler "Fairfax", K-12172, polished chrome, or approved equal in quality, performance, style and appearance. For Enlisted Quarters, faucet shall be Delta 400-WF, or approved equal in quality, performance, style and appearance.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel. Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

P-6 BATHTUB:

Straight front, recessed, 60 x 30 x 14 in, porcelain enameled formed steel with structural composite reinforcement ASME A112.19.4M. Color shall be white. Tub shall be American Standard "Princeton", or approved equal in quality, performance, style and appearance.

Drain Assembly - Plug, cup strainer, overflow assembly, washers, couplings, pop-up lever, trip lever, stopper, fittings, etc., shall be brass, cast copper alloy, or wrought copper alloy.

Bath Showers: Bath showers shall include bathtub spout, shower head, valves, diverters. A shower head mounting with ball joint and head integral with a formed wall plate shall be provided. Diverter shall be integral with single mixing valve. Mixing valve shall be a pressure-balancing type lever operated valve which shall maintain water temperature to within +/- 5F. Finish shall be chrome plate. Tub spout shall be copper alloy, chrome plate. Unit shall be Delta 1343, or approved equal in quality, performance, style and appearance.

P-8 Washer Box:

Clothes Washer: Drainage and hot and cold water supply shall be provided for automatic clothes washers. Washer connection, complete with 2-inch drain, 3/4-inch hose thread supplies shall be provided in standard

manufactured recessed wall box with single-face plate. Boxes shall be constructed of sheet steel. Steel boxes shall have a corrosion-resistant epoxy enamel finish. Boxes shall be mounted a minimum of 2 ft-10 inches above the finish floor. Electrical outlets for both washer and dryer shall not be installed as an integral part of the box but shall also be provided.

P-9 Refrigerator Ice Maker:

Cold water supply shall be provided for GF refrigerator ice makers. Ice maker connection shall include an angle valve and a 1/4 inch hose thread supply, and shall be provided in standard manufactured recessed wall box with single-face plate (plastic or steel). Boxes shall be mounted a minimum 2 ft-10 inches above the finish floor.

P-10 GARBAGE DISPOSAL MACHINES:

Garbage disposals machines shall be in accordance with CID A-A-50012. Garbage disposals shall be provided in each kitchen sink. Garbage disposals shall be provided with an integral connection for the dishwasher drain. Reference specification section 11401N, "ELECTRIC KITCHEN EQUIPMENT" for additional requirements.

PLUMBING FIXTURE SCHEDULE FOR 4-STAR QUARTERS

P-1 WATER CLOSET:

Siphon-jet, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic. The maximum water use shall be 1.6 gallons per flush.

Gasket shall be wax type.

Seat - IAPMO Z124.5, Shall be Kohler model K-4662 or approved equal in quality, performance, style, and appearance, except for Room 113. Seat for Room 113 shall be Kohler model K-4652 or approved equal in quality, performance, style, and appearance.

Flush Tank - An adequate quantity of water shall be provided to flush and clean the fixture served. The water supply to flush tanks equipped for manual flushing shall be controlled by a float valve or other automatic device designed to refill the tank after each discharge, and to completely shut off the water flow to the tank when the tank is filled to operational capacity. Water closets having their flush valve seat located below the flood level rim of the closet bowl shall have a ballcock installed within a sheath or in a separate and isolated compartment of the tank, both to have visible discharge onto the floor in case of failure. Provision shall be made to automatically supply water to the fixture so as to refill the trap seal after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled by a suitable timing device. Ballcocks shall meet ASSE 1002.

Flush Valve in Flush Tank - Flush valve seats in tanks for flushing water closets shall be at least 1 inch above the flood level rim of the bowl connected thereto, except in approved water closet and flush tank combinations designed so that when the tank is flushed and the fixture is clogged or partially clogged, the flush valve shall close tightly so that water will not spill continuously over the rim of the bowl or back flow

from the bowl to the tank.

Fixture Design - All water closets shall be white in color, except for Room 113, 210 and 216. Water closets for Room 113, 210 and 216 shall be biscuit in color.

Water closets shall bebe Kohler "Memoirs" model K-3462 or approved equal in quality, performance, style and appearance,except for Room 113. Water closet for Room 113 shall be Kohler "Memoirs" model K-3439 or approved equal in quality, performance, style and appearance.
Trip levers shall be polished brass except for Room 202 and 207 where they shall be polished chrome.

P-2 BATHTUB:

Bathtub for Room 202 and 207 shall be straight front, recessed, 60 x 32 x 17 in, cast iron, white. Tub shall be Kohler "Mendota" model K-505, or approved equal in quality, performance, style and appearance. Bathtub for Room 210 shall be 66 x 32 x 18 1/4 in, cast iron, drop-in 3-wall alcove, biscuit in color. Tub shall be Kohler "Maestro" model K-839 PB, or approved equal in quality, performance, style and appearance.

Drain Assembly - Plug, cup strainer, overflow assembly, washers, couplings, pop-up lever, trip lever, stopper, fittings, etc., shall be brass, cast copper alloy, or wrought copper alloy.

Bath Showers: Bath showers shall include bathtub spout, shower head, valves, diverters. A shower head mounting with ball joint and head integral with a formed wall plate shall be provided. Diverter shall be integral with single mixing valve. Mixing valve shall be a pressure-balancing type lever operated valve which shall maintain water temperature to within +/- 5F. Finish shall be polished chrome. Unit shall be Kohler model K-T16113-4A, or approved equal in quality, performance, style and appearance.

Bath faucet trim for Room 210 shall include two-handle deck-mount, with 3-way hand-shower and 2-way diverter, polished brass construction. Bath faucet trim shall be Kohler "Revival" model K-T16119-4A/K-300/K-16160, or approved equal in quality, performance, style and appearance.

P-2A SHOWER:

Shower head, CID A-A-240 shall be adjustable spray type and shall include a non-removable, tamperproof device to limit water flow to 2.5 gpm when tested in accordance with ASME A112.18.1M.

Showers shall include spout, shower head, valves, diverters. A shower head mounting with ball joint and head integral with a formed wall plate shall be provided. Diverter shall be integral with single mixing valve. Mixing valve shall be a pressure- balancing type lever operated valve which shall maintain water temperature to within +/- 5F. Finish shall be polished brass. Unit shall be Kohler "Revival" model K-T16114-4A/K-306-KS, or approved equal in quality, performance, style and appearance.

Drain Assembly - Plug, cup strainer, overflow assembly, washers, couplings, pop-up lever, trip lever, stopper, fittings, etc., shall be brass, cast copper alloy, or wrought copper alloy.

P-3 LAVATORY:

Manufacturer's standard sink depth, oval, and shall be integral with the vanity tops as specified in Section 06650, SOLID POLYMER(SOLID SURFACING)FABRICATIONS.

Lavatory in Room 113 shall be Corian Bowl, 19 x 15 in, or approved equal in quality, performance, style and appearance. Color shall be Bisque.

Lavatory in Room 202 and 207 shall be Corian Bowl, #810 undermount, 16 7/8 x 13 x 5 1/4 in, or approved equal in quality, performance, style and appearance. Color shall be standard white.

Lavatory in Room 210 and 216 shall be Corian Bowl, #815 undermount, large capacity, 20 7/16 x 14 7/16 x 6 1/8 in, or approved equal in quality, performance, style and appearance. Color shall be Bisque.

Faucets - Faucets shall be dual control, mixing type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.

Faucets in Room 113 shall be Moen model 4972P, with widespread crystal handles, aerator and spout or approved equal in quality, performance, style and appearance. Finish shall be polished brass.

Faucets in Room 202 and 207 shall be Kohler "Revival" model K-15286-B, with widespread, traditional spout, aerator and blade handles or approved equal in quality, performance, style and appearance. Finish shall be polished chrome.

Faucets in Room 210 and 216 shall be Kohler "Revival" model K-16102-4A, with widespread, scroll handles, aerator and spout or approved equal in quality, performance, style and appearance. Finish shall be polished brass.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

P-3A LAVATORY:

Lavatory shall be Kohler "Devonshire" model K-2886-8/K-2288 pedestal lavatory, 24 1/8 W x 19 3/4 D x 33 1/2 H in, with 8 inch centers or approved equal in quality, performance, style and appearance. Color shall be white.

Faucets shall be Kohler "Revival Classic" model K-16102-4A, with centerspread, scroll handles, aerator and spout or approved equal in quality, performance, style and appearance. Finish shall be polished brass.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

P-4 KITCHEN SINK:

Undercounter double(equal) compartment with squared bowls, 29 1/4 x 15 3/4 inches, stainless steel ASME A112.19.3M brushed finish, 9 1/2 inches deep left basin, 7 1/2 inches deep right basin. Sink shall include installation hardware and be Kohler "Undertone" model K-3351, or approved equal in quality, performance, style and appearance.

Faucet and Spout - Cast or wrought copper alloy. Aerator shall have internal threads. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing water pressure of 80 psi. Faucet shall be of brass construction with single hole mounting, 10 inch escutcheon plate, swing spout, white handspray and lever handle. Faucet shall be Kohler "Antique" model K-171, brushed nickel finish, or approved equal in quality, performance, style and appearance.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

P-4A BAR SINK:

Undercounter single compartment with rounded bowl, 9 1/4 x 15 3/8 x 5 1/2 inches, stainless steel ASME A112.19.3M brushed finish. Sink shall include installation hardware and be Kohler "Undertone" model K-3338, or approved equal in quality, performance, style and appearance.

Faucet and Spout - Cast or wrought copper alloy, gooseneck type with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Strainers shall have internal threads. Faucet shall be Kohler "Revival" model K-16112-4A, brushed nickel finish, or approved equal in quality, performance, style and appearance.

P-5 DISHWASHER:

Dishwasher shall be as specified in section 11401N, "ELECTRIC KITCHEN EQUIPMENT".

P-6 LAUNDRY SINK:

Single bowl, leg support 24 x 20 inches, enameled cast iron ASME A112.19.1M, or stainless steel ASME A112.19.3M.

Faucet and Spout - Cast copper alloy, wrought copper alloy, cast iron, or stainless steel, with backflow preventer. Faucets shall have replaceable seat and the stem shall rotate onto the seat. Strainers shall have internal threads. Combination faucets shall be mounted on the tub back. Spouts shall be externally threaded for hose connection.

Handles - Cast copper alloy, wrought copper alloy, or stainless steel, lever type.

P-7 GARBAGE DISPOSAL:

Garbage disposal shall be in accordance with CID A-A-50012. Garbage

disposal shall be provided with an integral connection for the dishwasher drain. Reference specification section 11401N, "ELECTRIC KITCHEN EQUIPMENT" for additional requirements.

3.8 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	B	C	D
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A 888		X	X	X
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X
10	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B	X			X
11	Seamless red brass pipe, ASTM B 43		X		
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X
13	Cast copper alloy solder joint pressure fittings, ASME B16.18				X
15	Cast bronze threaded fittings, ASME B16.15				X
16	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661,	X	X	X	X

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	B	C	D
	ASTM F 628				
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X

SERVICE:

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
* - Hard Temper

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE A	B	D
6	Bronze flanged fittings, ASME B16.24	X	X	X
7	Seamless copper pipe, ASTM B 42	X	X	
8	Seamless copper water tube, ASTM B 88, ASTM B 88M	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with 7	X	X	X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with 7	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 8 and 9	X	X	X
36	Nipples, pipe threaded ASTM A 733	X	X	

A - Cold Water Aboveground
B - Hot Water 180 degrees F Maximum Aboveground
D - Cold Water Service Belowground
Indicated types are minimum wall thicknesses.
** - Type L - Hard
*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors
**** - In or under slab floors only brazed joints

-- End of Section --

SECTION 15566

WARM AIR HEATING SYSTEMS
02/89

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR DIFFUSION COUNCIL (ADC)

ADC 1062:GRD	(1984) Test Codes for Grilles, Registers, and Diffusers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.47	(1998) Gas-Fired Furnaces

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 653/A 653M	(1999a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM D 520	(1984; R 1995el) Zinc Dust Pigment
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 3359	(1997) Measuring Adhesion by Tape Test

INTERNATIONAL APPROVAL SERVICES (IAS)

IAS Directory	(1998) IAS Directory of AGA & CGA Certified Appliances and Accessories

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1999) National Fuel Gas Code
NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(1999) Installation of Warm Air Heating and Air Conditioning Systems
NFPA 211	(200) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997)) HVAC Duct Construction Standards - Metal and Flexible
SMACNA Leakage Test Mnl	(1985) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL 181	(1996; Rev Dec 1998) Factory-Made Air Ducts and Air Connectors
UL 214	(1997) Tests for Flame-Propagation of Fabrics and Films
UL 1738	(1993; Rev thru Mar 1998) Venting Systems for Gas-Burning Appliances, Categories II, III and IV
UL Bld Mat Dir	(1999) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heating Equipment; G, ED
Installation; G, ED

Drawings shall consist of a complete list of equipment and material including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Drawings shall contain complete equipment wiring diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenance and equipment relationship to other parts of the work including clearances required for maintenance and operation.

SD-03 Product Data

Heating Equipment; G, ED

Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than 6 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 12 months operation, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 year(s) of service.

Tests;

Proposed test procedures for ductwork leak and performance tests, at least 2 weeks prior to the start of related testing.

System Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Similar Services

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Tests

Proposed test schedules for ductwork leak test and performance tests, at least 2 weeks prior to the start of related testing.

Field Training

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Tests; G, ED

Test reports for the ductwork leak test and the performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-10 Operation and Maintenance Data

Heating Equipment

Six manuals listing step-by-step procedures required for system startup, operation, shutdown and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tool that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the products. Equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.3.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.

1.3.3 Verification of Dimensions

After becoming familiar with all details of the work and working conditions, the Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing any work.

1.4 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.5 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be in accordance with NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

PART 2 PRODUCTS

2.1 SELF-CONTAINED FURNACE

Furnace shall be a manufacturer's standard, self-contained, forced circulated air heating type furnace as indicated. Furnace and furnace components shall be completely factory-assembled and wired. Furnace casing shall be factory insulated and be compatible with the operating temperatures. Furnace shall be provided with removable service panels which allow access to all internal components requiring cleaning, servicing, or adjustment.

2.1.1 Gas-Fired Unit

Gas-fired furnace shall be the high efficiency, condensing type in accordance with ANSI Z21.47. Furnace design shall be certified by the AMERICAN GAS ASSOCIATION LABORATORIES (AGA). Furnace shall have a minimum certified Annual Fuel Utilization Efficiency (AFUE) of not less than 90 percent.

2.2 FURNACE COMPONENTS

2.2.1 Gas-Burning Components

Gas-burning equipment shall include the gas burners, ignition equipment, gas-control valve, gas piping, gas-pressure regulating valve, when applicable, and accessories necessary for a fully automatic system that is listed in IAS Directory. Gas-fired units equipped with programming controls shall be furnished both with high and with low gas supply pressure switches in the fuel supply piping.

2.2.2 Ignition Systems

2.2.2.1 Gas-Fired Units

Ignition systems shall be of the direct spark, hot surface, or interrupted intermittent type with automatic electric ignition. The pilots shall be of the electrically-ignited proven type. Continuous pilots will not be permitted. Burner shall be designed in accordance with NFPA 54 and located so that parts are protected against overheating. Provisions shall be made in the burner housing for inspection of the pilot flame.

2.2.3 Supply Blowers

Blowers shall be centrifugal type. Blowers shall be statically and dynamically balanced. Lubrication points shall be located or extended, as required, to provide ready access for periodic lubrication. The direction of rotation shall be clearly and permanently marked on each blower housing. Blower speeds shall be single, or multispeed, as indicated, to provide the specified range of air temperature rises. Direct-drive blowers may have multiple speed motors to change blower speed. Belt-drive blowers shall be provided with an adjustable base and guard or enclosed in the unit casing. The belt drive shall be designed in accordance with the applicable Rubber Manufacturer's Association (RMA) power transmission belt specifications, with a service factor of at least 1.2. Shafts shall be supported by a minimum of two self-alining bearings. Blower speed shall be adjusted by the use of variable pitch drive sheaves.

2.2.4 Vents for High Efficiency Furnaces

Powered directventing shall be used for condensing type furnaces. Both the

air intake and exhaust vents shall be sized and located as indicated on the drawings and as recommended by the furnace manufacturer. A separate combustion air intake vent and exhaust shall be provided for each furnace. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases.

2.2.4.1 Combustion Air Intake Vent

The combustion air intake piping shall be constructed of Schedule 40 PVC in accordance with ASTM D 1784. The vent shall be suitable for the temperature at the furnace combustion air intake connection point. Each intake shall be provided complete with bird screen.

2.2.4.2 Exhaust Vent

The exhaust vent piping shall be constructed of Schedule 40 CPVC or stainless steel in accordance with UL 1738 and the furnace manufacturer's recommendations. The exhaust vent shall be suitable for the maximum anticipated furnace exhaust temperature and shall withstand the corrosive effects of the condensate. A 0.3125 inch diameter hole shall be provided in the stack not greater than 6 inches from the furnace flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the indoor space when samples are not being taken. Each exhaust stack shall be provided complete with bird screen.

2.3 AIR CONDITIONING EQUIPMENT

Cooling coils, condensers and related equipment shall be as specified in Section 15653 AIR-CONDITIONING SYSTEM.

2.4 CONTROLS

Furnace controls shall be provided by the furnace manufacturer as an integral part of the furnace. Electronic controls shall be provided. The controls shall allow for single stage operation in the GOQ Duplex and Enlisted units and two-stage in the GOQ Single units..

2.5 FUEL-GAS SUPPLY SYSTEM

Fuel-gas supply system shall be as specified in Section 15190 GAS PIPING SYSTEMS and Section 02556 GAS DISTRIBUTION SYSTEM.

2.6 DUCTWORK COMPONENTS

2.6.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Class 3 through 10 inch shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not

less than 3 equally spaced drive screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable.

2.6.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.6.1.2 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runouts length shall be as shown on the drawings, but shall not exceed 6 feet. Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall conform to the requirements of Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

2.6.1.3 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.6.2 Ductwork Accessories

2.6.2.1 Duct Access Doors

Access doors shall be provided in ductwork where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 by 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 by 24 inches or larger shall be provided with

fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.6.2.2 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portion of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrew. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.6.3 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.6.3.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 15 inches in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

2.6.3.2 Framed Prepared Opening

Openings shall have 1 inch clearance between the duct and the opening or 1 inch clearance between the insulation and the opening for insulated ducts.

2.6.3.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for all square, and rectangular ducts shall be fabricated from 18 gauge galvanized steel. Collars shall be installed with fasteners on maximum 6 inch

centers, except that not less than 4 fasteners shall be used.

2.6.4 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified in accordance with ADC 1062:GRD. Inlets and outlets shall be sound rated and certified in accordance with ADC 1062:GRD. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers.

2.6.4.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with antismudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.6.4.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.6.5 Sound Attenuation Equipment

Acoustical duct lining shall be fibrous glass designed exclusively for lining ductwork and shall conform to the requirements of ASTM C 1071, Type I and II. Liner composition may be uniform density, graduated density, or dual density, as standard with the manufacturer. Lining shall be coated, not less than 1 inch thick. Where acoustical duct liner is used, liner or combination of liner and insulation applied to the exterior of the ductwork shall be the thermal equivalent of the insulation specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Duct sizes shown shall be increased to compensate for the thickness of the lining used. In lieu of sheet metal duct with field-applied acoustical lining, acoustically equivalent lengths of fibrous glass duct or factory fabricated double-walled internally insulated duct with perforated liner may be provided. Net insertion loss value, static pressure drop, and air flow velocity capacity data shall be certified by a nationally recognized

independent acoustical laboratory.

2.7 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123/A 123M or ASTM A 653/A 653M shall be factory painted with a corrosion resisting paint finish, unless otherwise noted. Internal and external ferrous metal surfaces shall be cleaned, phosphated and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint in accordance with ASTM D 520, Type I.

PART 3 EXECUTION

3.1 INSTALLATION

The warm air heating installation shall conform to the requirements contained in NFPA 90A or NFPA 90B, as applicable. Combustion air supply and ventilation shall be in accordance with NFPA 54.

3.1.1 Furnaces

Foundations, settings, or suspensions for mounting equipment and accessories including supports, vibration isolators, stands, guides, anchors, clamps, and brackets shall be provided. Foundations and suspension for equipment shall conform to the recommendations of the manufacturer. Equipment shall be located as indicated and in such a manner that working space is available for all necessary servicing, such as shaft removal, replacing, or adjusting drives, motors, or shaft seals, air filters, access to automatic controls, humidifiers, and lubrication. Electrical isolation shall be provided between dissimilar metals for the purpose of minimizing galvanic corrosion. The interior of cabinets or casings shall be cleaned before completion of installation. The furnace shall be connected to the vent or chimney with the specified connectors, draft regulators, draft loads, and induced draft fans, as applicable, in accordance with NFPA 211.

3.1.2 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and so located that the concealed items may be serviced and maintained or completely removed for replacement. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.1.3 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.4 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07900 JOINT SEALING.

3.1.5 Metal Ductwork

Installation shall be in accordance with SMACNA HVAC Duct Const Stds unless otherwise indicated. Duct supports for sheet metal ductwork shall be in accordance with SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Supports shall be attached only to structural framing members and concrete slabs. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided.

3.1.6 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

3.1.7 Insulation

Thickness and application of insulation materials for ductwork and equipment shall be in accordance with Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.8 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.2 FIELD PAINTING

Finish painting of pipes, hangars, supports anditems only primed at the factory or surfaces not specifically noted, otherwise are specified in Section 09900 PAINTING, GENERAL.

3.3 CLEANING

Ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. All equipment requiring adjustment shall be adjusted to setting indicated or

directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.4 TESTS

Upon completion and prior to acceptance of the installation, the Contractor shall furnish all equipment, instruments, materials, labor, and supervision required for the tests as specified. Water, electricity, and fuel required for testing will be furnished by the Government. Defects disclosed by the tests shall be rectified. Tests shall be made under the direction and subject to the approval of the Contracting Officer. All indicating instruments shall be read at 1/2-hour intervals unless otherwise directed by the Contracting Officer.

3.4.1 Ductwork Leak Test

Ductwork leak test shall be performed for the entire air distribution system, including fans, coils, filters, etc. Test procedure, apparatus, and report shall conform to SMACNA Leakage Test Mnl. The maximum allowable leakage rate is 2 percent of the total system cfm. Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior.

3.4.2 Testing, Adjusting, and Balancing

Testing, adjusting, and balancing shall be as specified in SECTION 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.4.3 Performance Tests

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be conducted by an experienced engineer. Tests shall cover a period of not less than 5 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity in a shaded and weather protected area.

3.5 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 4 hours of normal working time shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved operating and maintenance instructions.

-- End of Section --

SECTION 15569

WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH
05/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13	(1991; Z21.13a; Z21.13b) Gas-Fired Low-Pressure Steam and Hot Water Boilers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 105/A 105M	(1998) Carbon Steel Forgings for Piping Applications
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 193/A 193M	(1999a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234/A 234M	(1999) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Services
ASTM A 515/A 515M	(1989; R 1997) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(1990; R 1996) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM B 32	(1996) Solder Metal
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1999) Seamless Copper Tube
ASTM B 88	(1999) Seamless Copper Water Tube

ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(1998) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1998) Power Piping
ASME B31.5	(1992; B31.5a1994) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IV	(1998) Boiler and Pressure Vessel Code; Section IV, Heating Boilers
ASME BPV VIII Div 1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1997) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA Tube Handbook	(1995) Copper Tube Handbook

HYDRONICS INSTITUTE DIVISION OF GAMA (HYI)

HYI-01	(1998) I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1999) National Fuel Gas Code

UNDERWRITERS LABORATORIES (UL)

UL 1738	(1993; Rev thru Mar 1998) Venting Systems for Gas-Burning Appliances, Categories II, III and IV
UL Gas&Oil Dir	(1999) Gas and Oil Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heating System; G, ED
Piping Installation; G, ED
Installation; G, ED

Detail drawings consisting of equipment layout including installation details and electrical connection diagrams; combustion and safety control diagrams; ductwork layout showing the location of supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of guides and anchors, the load imposed on each support or anchor (not required for radiant floor tubing), and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Manufacturer's Catalog Data; G, ED

Manufacturer's catalog data shall be included with the detail drawings for the following items:

Boilers
Fuel Burning Equipment
Combustion Control Equipment
Pumps
Fittings and Accessories
Water Treatment System

The data shall show model, size, options, etc., that are intended for consideration. Data submitted shall be adequate to demonstrate compliance with contract requirements.

Spare Parts Data;

Spare parts data for each different item of material and equipment, after approval of the detail drawings and no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current

unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 years of service.

Water Treatment Plan;

Six complete copies of the proposed water treatment plan. The plan shall include a layout, control scheme, a list of all chemicals, the proportion of chemicals to be added,, and a description of environmental concerns for handling the chemicals.

Heating System Tests; G, ED
Fuel System Tests; G, RE

Proposed test procedures for the heating system tests and fuel system tests, at least 2 weeks prior to the start of related testing.

Qualification;

A statement from the firms proposed to prepare submittals and perform installation and testing, demonstrating successful completion of similar services of at least five projects of similar size or scope, at least 2 weeks prior to the submittal of any other item required by this section.

Field Instructions; G, ED

System layout diagrams that show the layout of equipment, piping, and ductwork and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system, framed under glass or laminated plastic, at least 2 weeks prior to the start of related testing. After approval, these items shall be posted where directed.

Tests; G, RE

Proposed test schedules for the heating system and fuel system tests, at least 2 weeks prior to the start of related testing.

SD-06 Test Reports

Heating System Tests; G, ED
Fuel System Tests; G, RE

Test reports for the heating system tests and the fuel system test, upon completion of testing complete with results.

SD-07 Certificates

Continuous Emissions Monitoring;

Written certification by the boiler manufacturer that each boiler furnished complies with Federal, state, and local

regulations for emissions. The certification shall also include a description of applicable emission regulations. If any boiler is exempt from the emission regulations, the certification shall indicate the reason for the exemption.

SD-10 Operation and Maintenance Data

Heating System;

Six complete manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

Water Treatment System;

Six complete copies of operating and maintenance manuals for the step-by-step water treatment procedures, including procedures for testing the water quality.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.3.2 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

1.3.3 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment. Each pressure vessel shall have an approved ASME stamp.

1.3.4 Equipment Guards

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Catwalks, operating platforms, ladders, and guardrails shall be provided where shown and shall be constructed in accordance with Section 05500 MISCELLANEOUS METAL.

1.3.5 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work or ordering any materials.

1.4 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installing, adjusting, and testing of the equipment.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

PART 2 PRODUCTS

2.1 BOILERS

Each boiler shall have the output capacity in British thermal units per hour (Btuh) as indicated when fired with the specified fuels. The boiler shall be furnished complete with the gas burning equipment, boiler fittings and trim, automatic controls, forced or induced draft fan, electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. Boiler auxiliaries including fans, motors, drives, and similar equipment shall be provided with at least 10 percent excess capacity to allow for field variations in settings and to compensate for any unforeseen increases in pressure losses in appurtenant piping and ductwork. However, the boiler safety devices shall not be sized for a 10 percent excess capacity. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service. Boilers shall be designed, constructed, and equipped in accordance with ASME BPV IV. Each boiler shall be of the cast iron condensing type and designed for water service as specified herein. The boiler capacity shall be based on the ratings shown in HYI-01 or as certified by the American Boiler Manufacturers Association, or American Gas Association.

2.1.1 Cast Iron Boiler

Boiler shall be of the rectangular, sectional type, self-contained, packaged type, complete with accessories, mounted on a structural steel base. Cast iron sections shall be free of leaks under all operating conditions. Access shall be provided to permit cleaning of internal tube surfaces.

2.1.2 Condensing Boiler

Each boiler shall be a self-contained packaged type, complete with accessories, mounted on a structural steel base or a steel base which is integral to the boiler shell. Each boiler shall conform to the commercial design used by the manufacturer and shall permit free thermal expansion without placing undue stress on any part of the boiler. Each boiler which experiences the formation of condensate within the flue gas shall be specifically designed for condensing application. Each boiler shall withstand the corrosive effects of condensate for each part which may be in

contact with the condensate at all possible operating conditions. Each boiler shall be provided with a separate air intake, exhaust, and condensate drain. Each boiler shall be designed to withstand the water temperature differentials anticipated at the required operating conditions without experiencing any damage due to thermal shock.

2.1.3 Hot Water Heating Boilers

The hot water heating boiler shall be capable of operating at the specified maximum continuous capacity without damage or deterioration to the boiler, its setting, firing equipment, or auxiliaries. The rated capacity shall be the capacity at which the boiler will operate continuously while maintaining at least the specified minimum efficiency. The boiler design conditions shall be as follows:

a. Boiler design pressure 30 psig.

b. Operating pressure at boiler outlet 20 psig.

c. Hot water temperature 180 degrees F.

d. Temperature differential between boiler discharge and system return 20 degrees F.

e. Water pressure drop 2 psig.

f. Outdoor ambient air temperature 100 degrees F (max), 0 degrees F (min).

g. Site elevation 10 feet.

i. DOE Heating capacity 143,500 Btuh.

k. Condensing boilers shall have an Annual Fuel Utilization Efficiency of at least 86 percent.

2.2 FUEL BURNING EQUIPMENT

Boiler shall be designed to burn gas. Each boiler shall comply with Federal, state, and local emission regulations.

2.2.1 Burners

2.2.1.1 Gas Fired Burners and Controls

Burners shall be UL approved mechanical draft burners with all air necessary for combustion supplied by a blower where the operation is coordinated with the burner. Burner shall be provided complete with fuel supply system in conformance with the following safety codes or standards:

a. Gas-fired units shall conform to ANSI Z21.13.

2.2.2 Draft Damper

Boilers shall be provided with barometric dampers as recommended by the boiler manufacturer to maintain proper draft in the boiler.

2.3 COMBUSTION CONTROL EQUIPMENT

Combustion control equipment shall be provided as a system by the boiler manufacturer. The boiler water temperature shall be controlled by a water temperature controller. The equipment shall operate either electrically or pneumatically.

2.3.1 Electrical controls

Electrical control devices shall be provided as part of the boiler package.

2.3.2 Boiler Combustion Controls and Positioners

a. Gas boiler units shall be provided with fixed rate (on-off) combustion controls with hot surface or spark ignition.

d. Fixed rate on-off controls for boilers with capacities up to 600 kW (2,000,000 Btuh) shall use a water temperature controller in a temperature well in direct contact with the water.

2.3.3 Combustion Safety Controls and Equipment

Combustion safety controls and equipment shall be UL listed, microprocessor-based distributed process controller. The system shall include mounting hardware, wiring and cables, and associated equipment. The controller shall be mounted completely wired, programmed, debugged, and tested to perform all of its functions. The controller shall process the signals for complete control and monitoring of the boiler. This shall include maintaining boiler status, starting and stopping all control functions, sequencing control functions and signaling alarm conditions. The program shall be documented and include cross references in description of coils and contacts. Microprocessor shall be able to perform self diagnostics and contain a message center to provide operator with status and failure mode information.2.4 PUMPS

2.4.1 Hot Water Heating and Domestic Hot Water Circulating Pumps

Circulating pumps for hot water heating shall be electrically driven single-stage centrifugal type and have a capacity not less than indicated. Domestic hot water circulating pumps shall be provided as part of the boiler package. Hot water heating circulating pumps shall be supported by the piping on which installed and shall have a closed-coupled shaft. The pump shaft shall be constructed of corrosion-resistant alloy steel, sleeve bearings and glands of bronze designed to accommodate a mechanical seal, and the housing of close-grained cast iron. Pump seals shall be capable of withstanding 240 degrees F temperature without external cooling. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for the available electric service, and shall conform to the requirements of paragraph ELECTRICAL EQUIPMENT. Each pump suction and discharge connection shall be provided with a pressure gauge as specified.

2.5 COLD WATER CONNECTIONS

Connections shall be provided which includes consecutively in line a strainer, backflow prevention device, and water pressure regulator in that order in the direction of the flow. The backflow prevention device shall be provided as indicated and in compliance with Section 15400, PLUMBING, GENERAL PURPOSE. Cold water fill connections shall be made to the water supply system as indicated. Necessary pipe, fittings, and valves required

for water connections between the boiler and cold water main shall be provided as shown. The pressure regulating valve shall be of a type that will not stick or allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure of approximately,lately 5 psi in excess of the static head on the system and shall operate within a 2 psi tolerance regardless of cold water supply piping pressure and without objectionable noise under any condition of operation.

2.6 AIR HANDLING UNITS

Air handling units and associated equipment shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.7 FITTINGS AND ACCESSORIES

Boiler fittings and accessories shall be installed with each boiler in accordance with ASME BPV IV, unless otherwise specified.

2.7.1 Direct Vents

Direct venting shall be used for condensing type boilers. Both the air intake and exhaust vents shall be sized and located as indicated on the drawings and as recommended by the boiler manufacturer. A separate combustion air intake vent and exhaust vent shall be provided for each boiler.

2.7.1.1 Combustion Air Intake Vent

The combustion air intake piping shall be constructed of stainless steel. The vent shall be suitable for the temperature at the boiler combustion air intake connection point. Each intake shall be provided complete with bird screen.

2.7.1.2 Exhaust Vent

The exhaust vent piping shall be constructed of stainless steel conforming to UL 1738 and the boiler manufacturer's recommendations. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. The exhaust vent shall be suitable for the maximum anticipated boiler exhaust temperature and shall withstand the corrosive effects of the condensate. A 0.3125 inch diameter hole shall be provided in the stack not greater than 6 inches from the boiler flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the boiler room when samples are not being taken. Each exhaust stack shall be provided complete with bird screen.

2.7.2 Expansion Tank

The hot water pressurization system shall include a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. The sizes shall be as indicated. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 100 psi and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging

valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 250 degrees F.

2.7.3 Air Separator

External air separation tank shall be steel, constructed, tested for a working pressure of 125 psi. The capacity of the air separation tank indicated is minimum.

2.7.4 Gaskets

Gaskets shall be nonasbestos material in accordance with ASME B16.21, full face or self-centering type. The gaskets shall be of the spiral wound type with graphite filler material.

2.7.5 Steel Pipe and Fittings

2.7.5.1 Steel Pipe

Steel pipe shall be ASTM A 53/A 53M, Type E or S, Grade A or B, black steel, standard weight.

2.7.5.2 Steel Pipe Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.7.5.3 Steel Flanges

Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Flanges for high temperature water systems shall be serrated or raised-face type. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.7.5.4 Welded Fittings

Welded fittings shall conform to ASTM A 234/A 234M with WPA marking. Buttwelded fittings shall conform to ASME B16.9, and socket-welded fittings shall conform to ASME B16.11.

2.7.5.5 Cast-Iron Fittings

Fittings shall be ASME B16.4, Class 125, type required to match connecting piping.

2.7.5.6 Malleable-Iron Fittings

Fittings shall be ASME B16.3, type as required to match connecting piping.

2.7.5.7 Unions

Unions shall be ASME B16.39, Class 150.

2.7.5.8 Threads

Pipe threads shall conform to ASME B1.20.1.

2.7.6 Copper Tubing and Fittings

2.7.6.1 Copper Tubing

Tubing shall be ASTM B 88, ASTM B 88M, Type K or L. Adapters for copper tubing shall be brass or bronze for brazed fittings.

2.7.6.2 Solder-Joint Pressure Fittings

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18 and ASTM B 828.

2.7.6.3 Flared Fittings

Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62.

2.7.6.4 Adapters

Adapters may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used.

2.7.6.5 Threaded Fittings

Cast bronze threaded fittings shall conform to ASME B16.15.

2.7.6.6 Brazing Material

Brazing material shall conform to AWS A5.8.

2.7.6.7 Brazing Flux

Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides, and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.

2.7.6.8 Solder Material

Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

2.7.6.9 Solder Flux

Flux shall be either liquid or paste form, non-corrosive and conform to ASTM B 813.

2.7.7 Dielectric Waterways and Flanges

Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall

have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

2.7.8 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 125 psi or 150 psi service. Connectors shall be installed where indicated. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, and temperature medium. The flexible section shall be suitable for service intended and may have threaded, welded, soldered, flanged, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.7.9 Pipe Supports

Pipe supports shall conform to MSS SP-58 and MSS SP-69.

2.7.10 Pipe Expansion

2.7.10.1 Expansion Loops

Expansion loops and offsets shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1. The loops and offsets shall be cold-sprung and installed where indicated. Pipe guides and anchors shall be provided as required.

2.7.11 Valves

Valves shall be Class 125 and shall be suitable for the application. Grooved ends per AWWA C606 may be used for water service only. Valves in nonboiler external piping shall meet the material, fabrication and operating requirements of ASME B31.1. The connection type of all valves shall match the same type of connection required for the piping on which installed.

2.7.11.1 Gate Valves

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze rising stem, threaded, solder, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70 cast iron bronze trim, outside screw and yoke, flanged, or threaded ends.

2.7.11.2 Globe Valves

Globe valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Globe valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

2.7.11.3 Check Valves

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Check valves 3 inches and larger shall conform to MSS SP-71, cast iron, bronze trim, flanged, or threaded ends.

2.7.11.4 Angle Valves

Angle valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze, threaded, soldered, or flanged ends. Angle valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

2.7.11.5 Ball Valves

Ball valves 1/2 inch and larger shall conform to MSS SP-110, ductile iron or bronze, threaded, soldered, or flanged ends.

2.7.11.6 Balancing Valves

Balancing valves shall have meter connections with positive shutoff valves. An integral pointer shall register the degree of valve opening. Valves shall be calibrated so that flow rate can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 250 degrees F temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves, and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.

2.7.11.7 Automatic Flow Control Valves

In lieu of the specified balancing valves, automatic flow control valves may be provided to maintain constant flow and shall be designed to be sensitive to pressure differential across the valve to provide the required opening. Valves shall be selected for the flow required and provided with a permanent nameplate or tag carrying a permanent record of the factory-determined flow rate and flow control pressure levels. Valves shall control the flow within 5 percent of the tag rating. Valves shall be suitable for the maximum operating pressure of 125 psi or 150 percent of the system operating pressure, whichever is greater. Where the available system pressure is not adequate to provide the minimum pressure differential that still allows flow control, the system pump head capability shall be increased. Valves shall be suitable for 250 degrees F temperature service. Valve materials shall be same as specified for the heating system check, globe, angle, and gate valves. Valve operator shall be the electric motor type or pneumatic type as applicable. Valve operator shall be capable of positive shutoff against the system pump head. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential across the automatic flow control valve.

A portable meter shall be provided with accessory kit as recommended for the project by the automatic valve manufacturer.

2.7.11.8 Butterfly Valves

Butterfly valves shall be 2-flange type or lug wafer type, and shall be bubbletight at 150 psig. Valve bodies shall be cast iron, malleable iron, or steel. ASTM A 167, Type 404 or Type 316, corrosion resisting steel stems, bronze, or corrosion resisting steel discs, and synthetic rubber seats shall be provided. Valves smaller than 8 inches shall have throttling handles with a minimum of seven locking positions. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable balance return stops and position indicators. Valves in insulated lines shall have extended neck to accommodate insulation thickness.

2.7.11.9 Drain valves

Drain valves shall be provided at each drain point of blowdown as recommended by the boiler manufacturer. Piping shall conform to ASME BPV IV and ASTM A 53/A 53M.

2.7.11.10 Safety Valves

Safety valves shall have steel bodies and shall be equipped with corrosion-resistant trim and valve seats. The valves shall be properly guided and shall be positive closing so that no leakage can occur. Adjustment of the desired back-pressure shall cover the range between 2 and 10 psig. The adjustment shall be made externally, and any shafts extending through the valve body shall be provided with adjustable stuffing boxes having renewable packing. Boiler safety valves of proper size and of the required number, in accordance with ASME BPV IV, shall be installed so that the discharge will be through piping extended to a location as indicated. Each discharge pipe for hot water service shall be pitched away from the valve seat.

2.7.12 Strainers

Basket and "Y" type strainers shall be the same size as the pipelines in which they are installed. The strainer bodies shall be heavy and durable, fabricated of cast iron, and shall have bottoms drilled and tapped with a gate valve attached for blowdown purposes. Strainers shall be designed for 125 psig service and 200 degrees F. The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment screen. The screen shall be made of 22 gauge monel or corrosion-resistant steel with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.7.13 Pressure Gauges

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shutoff valve. Minimum dial size shall be 3-1/2 inches. A pressure gauge shall be provided for each boiler in a visible location on the boiler. Pressure gauges shall be provided with readings in Kpa and psi. Pressure gauges shall have an indicating pressure range that is related to the operating pressure of the fluid in accordance with the following table:

Operating Pressure (psi)	Pressure Range (psi)
76-150	0-200
16-75	0-100
2-15	0-30 (retard)

2.7.14 Thermometers

Thermometers shall be provided with wells and separable corrosion-resistant steel sockets. Thermometers for inlet water and outlet water for each hot water boiler shall be provided in a visible location on the boiler. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a minimum 9 inch scale. The operating range of the thermometers shall be 32 - 212 degrees Fahrenheit. The thermometers shall be provided with readings in degrees Fahrenheit.

2.7.15 Air Vents

2.7.15.1 Manual Air Vents

Manual air vents shall be brass or bronze valves or cocks suitable for the pressure rating of the piping system and furnished with threaded plugs or caps.

2.7.15.2 Automatic Air Vents

Automatic air vents shall be 3/4 inch quick-venting float and vacuum air valves. Each air vent valve shall have a large port permitting the expulsion of the air without developing excessive back pressure, a noncollapsible metal float which will close the valve and prevent the loss of water from the system, an air seal that will effectively close and prevent the re-entry of air into the system when subatmospheric pressures prevail therein, and a thermostatic member that will close the port against the passage of steam from the system. The name of the manufacturer shall be clearly stamped on the outside of each valve. The air vent valve shall be suitable for the pressure rating of the piping system.

2.8 ELECTRICAL EQUIPMENT

Electric motor-driven equipment shall be provided complete with motors, motor starters, and necessary control devices. Electrical equipment, motor control devices, motor efficiencies and wiring shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Motors which are not an integral part of a packaged boiler shall be rated for high efficiency service. Motors which are an integral part of the packaged boiler shall be the highest efficiency available by the manufacturer of the packaged boiler. Motor starters shall be provided complete with properly sized thermal overload protections and other appurtenances necessary for the motor control specified. Starters shall be furnished in general purpose enclosures. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices but not shown shall be provided.

2.8.1 Motor Ratings

Motors shall be suitable for the voltage and frequency provided. Motors 1/2 hp and larger shall be three-phase, unless otherwise indicated. Motors shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor.

2.8.2 Motor Controls

Motor controllers shall be provided complete with properly sized thermal overload protection. Manual or automatic control and protective or signal devices required for the operation specified and any wiring required to such devices shall be provided.

2.9 INSULATION

Shop and field-applied insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.10 TOOLS

Special tools shall be furnished. Special tools shall include uncommon tools necessary for the operation and maintenance of boilers, burners, pumps, fans, controls, meters, special piping systems, and other equipment. Small hand tools shall be furnished within a suitable cabinet, mounted where directed.

2.11 BOILER WATER TREATMENT

The water treatment system shall be capable of feeding chemicals and bleeding the system to prevent corrosion and scale within the boiler and piping distribution system. The water shall be treated to maintain the conditions recommended by the boiler manufacturer. Chemicals shall meet required federal, state, and local environmental regulations for the treatment of boilers and discharge to the sanitary sewer. The services of a company regularly engaged in the treatment of boilers shall be used to determine the correct chemicals and concentrations required for water treatment. The company shall maintain the chemical treatment and provide all chemicals required for a period of 1 year from the date of occupancy. Filming amines and proprietary chemicals shall not be used. The water treatment chemicals shall remain stable throughout the operating temperature range of the system and shall be compatible with pump seals and other elements of the system.

2.11.1 Chemical Shot Feeder

A shot feeder shall be provided as indicated. Size and capacity of feeder shall be based upon local requirements. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

2.11.2 Chemical Piping

The piping and fittings shall be constructed of schedule 80 PVC.

2.11.3 Test Kits

One test kit of each type required to determine the water quality as outlined within the operation and maintenance manuals shall be provided.

PART 3 EXECUTION

3.1 ERECTION OF BOILER AND AUXILIARY EQUIPMENT

Boiler and auxiliary equipment shall be installed in accordance with manufacturer's written instructions. Boiler supports shall permit free expansion and contraction of each portion of the boiler without placing undue stress on any part of the boiler or setting. Boiler breeching shall be as indicated with full provision for expansion and contraction between all interconnected components.

3.2 PIPING INSTALLATION

Unless otherwise specified, nonboiler external pipe and fittings shall conform to the requirements of ASME B31.1. Pipe installed shall be cut accurately to suit field conditions, shall be installed without springing or forcing, and shall properly clear windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted. Pipes shall be free of burrs, oil, grease and other foreign material and shall be installed to permit free expansion and contraction without damaging the building structure, pipe, pipe joints, or pipe supports. Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. Vent pipes shall be carried through the roof as directed and shall be properly flashed. Unless otherwise indicated, horizontal supply mains shall pitch down in the direction of flow with a grade of not less than 1 inch in 40 feet. Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unless otherwise specified or shown, final connections to equipment shall be made with malleable-iron unions for steel pipe 2-1/2 inches or less in diameter and with flanges for pipe 3 inches or more in diameter. Unions for copper pipe or tubing shall be brass or bronze. Reducing fittings shall be used for changes in pipe sizes. In horizontal hot water lines, reducing fittings shall be eccentric type to maintain the top of the lines at the same level to prevent air binding.

3.2.1 Hot Water Piping and Fittings

Pipe shall be black steel or copper tubing. Fittings for steel piping shall be black malleable iron or cast iron to suit piping. Fittings adjacent to valves shall suit valve material. Grooved mechanical fittings will not be allowed.

3.2.2 Vent Piping and Fittings

Vent piping shall be black steel. Fittings shall be black malleable iron or cast iron to suit piping.

3.2.3 Gauge Piping

Piping shall be copper tubing.

3.2.4 Joints

Joints between sections of steel pipe and between steel pipe and fittings

shall be threaded, flanged or welded as indicated or specified. Except as otherwise specified, fittings 1 inch and smaller shall be threaded; fittings 1-1/4 inches and up to but not including 3 inches shall be either threaded, or welded; and fittings 3 inches and larger shall be either flanged, or welded. Pipe and fittings 1-1/4 inches and larger installed in inaccessible conduit or trenches beneath concrete floor slabs shall be welded. Connections to equipment shall be made with black malleable-iron unions for pipe 2-1/2 inches or smaller in diameter and with flanges for pipe 3 inchesinches or larger in diameter. Joints between sections of copper tubing or pipe shall be flared, soldered, or brazed.

3.2.4.1 Threaded Joints

Threaded joints shall be made with tapered threads properly cut and shall be made perfectly tight with a stiff mixture of graphite and oil or with polytetrafluoroethylene tape applied to the male threads only and in no case to the fittings.

3.2.4.2 Welded Joints

Welded joints shall be in accordance with paragraph GENERAL REQUIREMENTS unless otherwise specified. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connections may be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitation. Branch outlet fittings, where used, shall be forged, flared for improved flow characteristics where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Socket weld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1/16 inch and no more than 1/8 inch.

3.2.4.3 Flared and Brazed Copper Pipe and Tubing

Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA Tube Handbook with flux. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorous, copper-phosphorous-silver or a silver brazing filler metal. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided in all branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing. Flared or brazed copper tubing to pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing.

3.2.4.4 Soldered Joints

Soldered joints shall be made with flux and are only acceptable for lines 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA Tube Handbook.

3.2.5 Flanges and Unions

Flanges shall be faced true, provided with 1/16 inch thick gaskets, and made square and tight. Where steel flanges mate with cast-iron flanged fittings, valves, or equipment, they shall be provided with flat faces and full face gaskets. Union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Dielectric pipe unions shall be provided between ferrous and nonferrous piping to prevent galvanic corrosion. The dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. The metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Gaskets, flanges, and unions shall be installed in accordance with manufacturer's recommendations.

3.2.6 Branch Connections

3.2.6.1 Branch Connections for Hot Water Systems

Branches from the main shall pitch up or down as shown to prevent air entrapment. Connections shall ensure unrestricted circulation, eliminate air pockets, and permit complete drainage of the system. Branches shall pitch with a grade of not less than 1 inch in 10 feet. When indicated, special flow fittings shall be installed on the mains to bypass portions of the water through each radiator. Special flow fittings shall be standard catalog products and shall be installed as recommended by the manufacturer.

3.2.7 Flared, Brazed, and Soldered Copper Pipe and Tubing

Copper tubing shall be flared, brazed, or soldered. Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided on branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing. Pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing. Brazed joints shall be made in conformance with MSS SP-73, and CDA Tube Handbook. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorous, copper-phosphorous-silver, or a silver brazing filler metal. Soldered joints shall be made with flux and are only acceptable for lines 2 inches or smaller. Soldered joints shall conform to ASME B31.5 and shall be in accordance with CDA Tube Handbook.

3.2.8 Supports

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling,

swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. Threaded rods which are used for support shall not be formed or bent.

3.2.8.1 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe, if the clamp bottom does not extend through the insulation, and if the top clamp attachment does not contact the insulation during pipe movement.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices furnished by the manufacturer. Field fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.

h. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet,not more than 8 feet from end of risers, and at vent terminations.

i. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

(1) Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle may be welded to the pipe and freely rested on a steel plate. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rested on a steel slide plate.

(2) Where there are high system temperatures and welding to piping is not desirable, the Type 35 guide shall include a pipe

cradle welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

j. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

k. Piping in trenches shall be supported as indicated.

l. Structural steel attachments and brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL. Pipe hanger loads suspended from steel joist between panel points shall not exceed 50 pounds. Loads exceeding 50 pounds shall be suspended from panel points.

3.2.8.2 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support member shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run. The clips or clamps shall be rigidly attached to the common base member. A clearance of 1/8 inch shall be provided between the pipe insulation and the clip or clamp for piping which may be subjected to thermal expansion.

3.2.9 Valves

Valves shall be installed where indicated, specified, and required for functioning and servicing of the systems. Valves shall be safely accessible. Swing check valves shall be installed upright in horizontal lines and in vertical lines only when flow is in the upward direction. Gate and globe valves shall be installed with stems horizontal or above. Valves to be brazed shall be disassembled prior to brazing and all packing removed. After brazing, the valves shall be allowed to cool before reassembling.

3.2.10 Pipe Sleeves

Pipe passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. A waterproofing clamping flange shall be installed as indicated where membranes are involved. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof. Sleeves through walls shall be cut flush with wall surface. Sleeves through floors shall extend above top surface of floor a sufficient distance to allow proper flashing or finishing. Sleeves through roofs shall extend above the top surface of roof at least 6 inches for proper flashing or finishing. Unless otherwise indicated, sleeves shall be sized to provide a minimum clearance of 1/4 inch between bare pipe and sleeves or between jacket over insulation and sleeves. Sleeves in waterproofing membrane floors, bearing walls, and wet areas shall be galvanized steel pipe or cast-iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be galvanized steel pipe, cast-iron pipe, or galvanized sheet metal with lock-type longitudinal seam. Except in pipe chases or interior walls, the annular space between pipe and sleeve or

between jacket over insulation and sleeve in nonfire rated walls shall be sealed as indicated and specified in Section 07900 JOINT SEALING. Metal jackets shall be provided over insulation passing through exterior walls, firewalls, fire partitions, floors, or roofs.

a. Metal jackets shall not be thinner than 0.006 inch thick aluminum, if corrugated, and 0.016 inch thick aluminum, if smooth.

b. Metal jackets shall be secured with aluminum or stainless steel bands not less than 3/8 inch wide and not more than 8 inches apart. When penetrating roofs and before fitting the metal jacket into place, a 1/2 inch wide strip of sealant shall be run vertically along the inside of the longitudinal joint of the metal jacket from a point below the backup material to a minimum height of 36 inches above the roof. If the pipe turns from vertical to horizontal, the sealant strip shall be run to a point just beyond the first elbow. When penetrating waterproofing membrane for floors, the metal jacket shall extend from a point below the back-up material to a minimum distance of 2 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above material to a minimum distance of 2 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above the floor; when passing through walls above grade, the jacket shall extend at least 4 inches beyond each side of the wall.

3.2.10.1 Pipes Passing Through Waterproofing Membranes

In addition to the pipe sleeves referred to above, pipes passing through waterproofing membranes shall be provided with a 4 pound lead flashing or a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than inches from the pipe and shall set over the membrane in a troweled coating of bituminous cement. The flashing shall extend above the roof or floor a minimum of 10 inches. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Pipes up to and including 10 inchesin diameter which pass through waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

3.2.10.2 Optional Modular Mechanical Sealing Assembly

At the option of the Contractor, a modular mechanical type sealing assembly may be installed in the annular space between the sleeve and conduit or pipe in lieu of a waterproofing clamping flange and caulking and sealing specified above. The seals shall include interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved.

3.2.10.3 Optional Counterflashing

As alternates to caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may consist of standard roof coupling for threaded pipe up to 6 inches in diameter, lead flashing sleeve for dry vents with the sleeve turned down into the pipe to form a waterproof joint, or a tack-welded or banded-metal rain shield around the pipe, sealed as indicated.

3.2.10.4 Fire Seal

Where pipes pass through firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.2.11 Balancing Valves

Balancing valves shall be installed as indicated.

3.2.12 Thermometer Wells

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

3.2.13 Air Vents

Air vents shall be installed where shown or directed. Air vents shall be installed in piping at all system high points. The vent shall remain open until water rises in the tank or pipe to a predetermined level at which time it shall close tight. An overflow pipe from the vent shall be run to a point designated by the Contracting Officer's representative. The inlet to the air vent shall have a gate valve or ball valve.

3.2.14 Escutcheons

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrews.

3.2.15 Drains

A drain connection with a 1 inch gate valve or 3/4 inch hose bib shall be installed at the lowest point in the return main near the boiler. In addition, threaded drain connections with threaded cap or plug shall be installed on the heat exchanger coil on each unit heater or unit ventilator and wherever required for thorough draining of the system.

3.2.16 Strainer Blow-Down Piping

Strainer blow-down connections shall be fitted with a black steel blow-down pipeline routed to an accessible location and provided with a blow-down valve.

3.2.17 Direct Venting for Combustion Intake Air and Exhaust Air

The intake air and exhaust vents shall be installed in accordance with NFPA

54 and boiler manufacturer's recommendations. The exhaust vent shall be sloped 1/4 inch per ft toward the boiler's flue gas condensate collection point.

3.3 GAS FUEL SYSTEM

Gas piping, fittings, valves, regulators, tests, cleaning, and adjustments shall be in accordance with the Section 15190 GAS PIPING SYSTEMS. NFPA 54 shall be complied with unless otherwise specified. Burners, pilots, and all accessories shall be listed in UL Gas&Oil Dir. The fuel system shall be provided with a gas tight, manually operated, UL listed stop valve at the gas-supply connections, a gas strainer, a pressure regulator, pressure gauges, a burner-control valve, a safety shutoff valve suitable for size of burner and sequence of operation, and other components required for safe, efficient, and reliable operation as specified. Approved permanent and ready facilities to permit periodic valve leakage tests on the safety shutoff valve or valves shall be provided.

3.4 COLOR CODE MARKING AND FIELD PAINTING

Color code marking of piping shall be as specified in Section 09900 PAINTING GENERAL. Ferrous metal not specified to be coated at the factory shall be cleaned, prepared, and painted as specified in Section 09900 PAINTING, GENERAL. Exposed pipe covering shall be painted as specified in Section 09900 PAINTING, GENERAL. Aluminum sheath over insulation shall not be painted.

3.5 TEST OF BACKFLOW PREVENTION ASSEMBLIES

Backflow prevention assemblies shall be tested in accordance with Section 15400, PLUMBING, GENERAL PURPOSE.

3.6 HEATING SYSTEM TESTS

Before any covering is installed on pipe or heating equipment, the entire heating system's piping, fittings, and terminal heating units shall be hydrostatically tested and proved tight at a pressure of 1-1/2 times the design working pressure, but not less than 100 psi. Before pressurizing system for test, items or equipment (e.g., vessels, pumps, instruments, controls, relief valves) rated for pressures below the test pressure shall be blanked off or replaced with spool pieces. Before balancing and final operating test, test blanks and spool pieces shall be removed; and protected instruments and equipment shall be reconnected. With equipment items protected, the system shall be pressurized to test pressure. Pressure shall be held for a period of time sufficient to inspect all welds, joints, and connections for leaks, but not less than 2 hours. No loss of pressure will be allowed. Leaks shall be repaired and repaired joints shall be retested. The pressure shall be held while inspecting these joints and connections for leaks. The leaks shall be repaired and the repaired joints retested. Upon completion of hydrostatic tests and before acceptance of the installation, the Contractor shall balance the heating system in accordance with Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS; and operating tests required to demonstrate satisfactory functional and operational efficiency shall be performed. The operating test shall cover a period of at least 24 hours for each system, and shall include, as a minimum, the following specific information in a report, together with conclusions as to the adequacy of the system:

a. Certification of balancing.

b. Time, date, and duration of test.

c. Outside and inside dry bulb temperatures.

d. Temperature of hot water supply leaving boiler.

e. Temperature of heating return water from system at boiler inlet.

f. Quantity of water feed to boiler.

g. Boiler make, type, serial number, design pressure, and rated capacity.

h. Fuel burner make, model, and rated capacity; ammeter and voltmeter readings for burner motor.

i. Circulating pump make, model, and rated capacity, and ammeter and voltmeter readings for pump motor during operation.

o. Quantity of water circulated.

Indicating instruments shall be read at half-hour intervals unless otherwise directed. The Contractor shall furnish all instruments, equipment, and personnel required for the tests and balancing. Fuels, water, and electricity shall be obtained as specified in the SPECIAL CONTRACT REQUIREMENTS. Operating tests shall demonstrate that fuel burners and combustion and safety controls meet the requirements of ANSI Z21.13

3.6.1 Water Treatment Testing

3.6.1.1 Water Quality Test

The boiler water shall be analyzed prior to the acceptance of the facility by the water treatment company to determine the requirements for a one time treatment of the system water.
If the boiler water is not in conformance with the boiler manufacturer's recommendations, the water treatment company shall take corrective action.

3.7 CLEANING

3.7.1 Boilers and Piping

After the hydrostatic tests have been made and before the system is balanced and operating tests are performed, the boilers and feed water piping shall be thoroughly cleaned by filling the system with a solution consisting of either 1 pound of caustic soda or 1 pound of trisodium phosphate per 50 gallons of water. The proper safety precautions shall be observed in the handling and use of these chemicals. The water shall be heated to approximately 150 degrees F and the solution circulated in the system for a period of 48 hours. The system shall then be drained and thoroughly flushed out with fresh water. Strainers and valves shall be thoroughly cleaned. Prior to operating tests, air shall be removed from all water systems by operating the air vents.

3.7.2 Heating Units

Inside space heating equipment, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish

and dust and then vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for fans that are operated during construction, and new filters shall be installed after construction dirt has been removed from the building, and the ducts, plenum, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.8 FUEL SYSTEM TESTS

3.8.1 Gas System Test

The gas fuel system shall be tested in accordance with the test procedures outlined in NFPA 54.

3.9 FIELD TRAINING

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operation and maintenance instructions, as well as demonstrations of routine maintenance operations and boiler safety devices. The Contracting Officer shall be notified at least 14 days prior to date of proposed conduction of the training course.

-- End of Section --

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
02/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1989) Central-Station Air-Handling Units
ARI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210	(1985) Laboratory Methods of Testing Fans for Rating
AMCA 300	(1996) Reverberant Room Method for Sound Testing of Fans

AMERICAN BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA Std 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
AFBMA Std 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1071	(1998) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 68	(1986) Laboratory Method of Testing In-Duct Sound Power Measurement Procedures

for Fans

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 586	(1996; Rev thru Aug 1999) High-Efficiency, Particulate, Air Filter Units
UL 900	(1994; Rev thru Nov 1999) Test Performance of Air Filter Units

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings

Drawings shall consist of equipment layout including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Components and Equipment; G, ED

Manufacturer's catalog data shall be included with the detail drawings for the following items. The data shall be highlighted

to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

b. Ductwork Components

c. Air Systems Equipment

Test Procedures

Proposed test procedures ductwork leak test at least 2 weeks prior to the start of related testing.

Similar Services

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Testing, Adjusting and Balancing

Proposed test schedules for hydrostatic test of piping, ductwork leak test, and performance tests, at least 2 weeks prior to the start of related testing.

Field Training

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Performance Tests;

Test reports for the ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.5 DUCTWORK COMPONENTS

2.5.1 Metal Ductwork

Ductwork shall be as specified in Section 15566 WARM AIR HEATING SYSTEMS.

2.6 AIR SYSTEMS EQUIPMENT

2.6.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans are to be directly connected to the motors. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Fan performance curve for each fan shall be submitted. Sound power level shall be as indicated. Sound power data for each fan shall be submitted The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.6.1.1 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a welded tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by AFBMA Std 9 and AFBMA Std 11. Motors shall be permanently lubricated and carefully matched to the fan loads.

2.6.1.2 Propeller Fans

Fans shall be direct drive. Propellers shall have aluminum blades and be statically and dynamically balanced. Motors shall be open drip proof type with permanently lubricated bearings with built-in thermal overload protection. Fan shall bear the AMCA licensed ratings seal for air and sound performance and shall be UL listed. Fan shall be of bolted and welded construction on a coated steel fan panel with welded corners,

mounting holes and integral venturi.

2.6.1.3 Ceiling Exhaust Fans

Suspended cabinet-type ceiling exhaust fans shall be centrifugal type, direct-driven. Fans shall have acoustically insulated housing. Integral backdraft damper shall be chatter-proof. The integral face grille shall be of egg-crate design or louver design. Fan motors shall be mounted on vibration isolators. Unit shall be provided with mounting flange for hanging unit from above. Fans shall be U.L. listed.

2.6.1.4 Range Hood Wall Jack

Hooded rectangle shape with duct connection sized as indicated, spring-loaded backdraft damper, birdscreen, aluminum construction natural finish.

2.6.1.5 Exhaust Fan Wall Jack

Hooded square shape with duct connection, size as indicated, spring loaded backdraft damper, birdscreen, aluminum construction natural finish.

2.6.1.6 Dryer Exhaust Wall Cap

Provide hooded square with duct connection, size as indicated, spring loaded backdraft damper, birdscreen, aluminum construction natural finish.

2.6.2 Coils

Coils shall be fin-and-tube type constructed of seamless copper tubes and aluminum or copper fins mechanically bonded or soldered to the tubes. Copper tube wall thickness shall be a minimum of 0.020 inches. Aluminum fins shall be 0.0075 inch minimum thickness. Copper fins shall be 0.0045 inch minimum thickness. Casing and tube support sheets shall be not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 400 psi air pressure and shall be suitable for 200 psi working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

2.6.2.1 Direct-Expansion Coils

Direct-expansion coils shall be suitable for the refrigerant involved. Suction headers shall be seamless copper tubing or seamless or resistance welded steel tube with copper connections. Supply headers shall consist of a distributor which shall distribute the refrigerant through seamless copper tubing equally to all circuits in the coil. Tubes shall be circuited to ensure minimum pressure drop and maximum heat transfer. Circuiting shall permit refrigerant flow from inlet to suction outlet without causing oil slugging or restricting refrigerant flow in coil. Each coil to be field installed shall be completely dehydrated and sealed at the factory upon completion of pressure tests.

2.6.2.2 Water Coils

Water coils shall be installed with a pitch of not less than 1/8 inch per foot of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a

plugged vent and drain connection extending through the unit casing.

2.6.3 Air Filters

Air filters shall be listed according to requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method shall be as listed under the Label Service and shall meet the requirements of UL 586.

2.6.3.1 Replaceable Media Filters

Replaceable media filters shall be the dry-media type, of the size required to suit the application. Filtering media shall be not less than 1 inch thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Pad shall be enclosed in a holding frame of not less than 16 gauge galvanized steel, and equipped with quick-opening mechanism for changing filter media. Average efficiency shall be not less than 20 percent when tested according to ASHRAE 52.1.

2.6.3.2 Electronic AIr Cleaner

Electronic air cleaner shall be duct mounted suitable for mounting in the vertical or horizontal position of the return air duct system. Unit shall be fully assembled,constructed of a heavy-gage steel cabinet, UL listed and capable of converting 120VAC power supply to DC current that utilizes a charged collecting plate to remove airborne particles.

2.7 AIR HANDLING UNITS

2.7.1 Factory-Fabricated Air Handling Units

Units shall be single-zone draw-through type as indicated. Units shall include fans, coils, airtight insulated casing, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, vibration-isolators, and appurtenances required for specified operation. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

2.7.1.1 Casings

Casing sections shall be single wall type, constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Casing shall be designed and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 18 gauge outer and 20 gauge inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be minimum 24 inches wide and shall be the full height of the unit casing or a minimum of 6 ft., whichever is less. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-bottom type constructed of 16 gauge galvanized steel or thermoplastic, pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion,

and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Each casing section handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Foam-type insulation is not acceptable. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections.

2.7.1.2 Heating and Cooling Coils

Coils shall be provided as specified in paragraph AIR SYSTEMS EQUIPMENT, for types indicated.

2.7.1.3 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.7.1.4 Fans

Fans shall be double-inlet, centrifugal type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by AFBMA Std 9 and AFBMA Std 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by ARI Guideline D. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have splashproof enclosures. Motor starters shall be magnetic across-the-line type with general-purpose enclosure. Unit fan

or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300 or ASHRAE 68.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Metal Ductwork

Installation shall be **as specified in Section 15566 WARM AIR HEATING SYSTEMS**.

3.2 CLEANING AND ADJUSTING

Ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.3 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.4 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 2 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.5 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 4 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items

contained in the approved Operating and Maintenance Instructions.

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		03900	SD-07 Certificates																
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			Inspection	3.3														
		07900A	SD-03 Product Data															
			Backing	2.1														
			Bond-Breaker	2.2														
			Sealant	2.4														
			SD-07 Certificates															
			Sealant	2.4														
		08110	SD-02 Shop Drawings															
			Doors	2.1	G	G												
			Doors	2.1	G	G												
			Frames	2.4	G	G												
			Frames	2.4	G	G												
			Accessories	2.2														
			Weatherstripping	2.5														
			SD-03 Product Data															
			Doors	2.1	G													
			Frames	2.4	G													
			Accessories	2.2														
			Weatherstripping	2.5														
		08181	SD-02 Shop Drawings															
			Storm doors	2.1.4														
			SD-03 Product Data															
			Storm doors	2.1.4														
			Hardware	2.1.4.1														
			SD-04 Samples															

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		08181	Storm doors	2.1.4														
			finishes	2.3	G													
			SD-06 Test Reports															
			Storm doors	2.1.4														
			SD-10 Operation and Maintenance															
			Data															
			Storm doors	2.1.4														
		08210	SD-02 Shop Drawings															
			Doors	2.1	G													
			SD-03 Product Data															
			Doors	2.1	G													
			Accessories	2.2														
			Water-resistant sealer	3.1														
			SD-04 Samples															
			Doors	2.1														
		08520A	SD-02 Shop Drawings															
			Aluminum Windows	2.1	G													
			SD-03 Product Data															
			Aluminum Windows	2.1	G													
			SD-04 Samples															
			Aluminum Windows	2.1	G													
			SD-06 Test Reports															
			Aluminum Windows	2.1														
			SD-07 Certificates															
			Aluminum Windows	2.1														
		08550	SD-02 Shop Drawings															

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		08550	Aluminum Clad Wood windows	2.1	G													
			SD-03 Product Data															
			Aluminum Clad Wood windows	2.1	G													
			SD-04 Samples															
			Aluminum Clad Wood windows	2.1	G													
			SD-08 Manufacturer's Instructions															
			Aluminum Clad Wood windows	2.1														
			SD-10 Operation and Maintenance															
			Data															
			Aluminum Clad Wood windows	2.1														
		08710	SD-02 Shop Drawings															
			Hardware schedule	1.3	G													
			Keying system	2.2.4														
			SD-03 Product Data															
			Hardware items	2.2	G													
			SD-08 Manufacturer's Instructions															
			Installation	3.1														
			SD-10 Operation and Maintenance															
			Data															
			Hardware Schedule	1.3														
			SD-11 Closeout Submittals															
			Key bitting	1.4														
		08810A	SD-02 Shop Drawings															
			Installation	3.2														
			SD-03 Product Data															
			Glass	2.1														

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		08810A	Glazing Accessories	2.6														
			SD-04 Samples															
			Glass	2.1	G													
			SD-07 Certificates															
			Glass	2.1														
		09215A	SD-03 Product Data															
			Materials	2.1														
			SD-07 Certificates															
			Fire Resistive Construction	1.7														
		09225A	SD-03 Product Data															
			Materials	1.3														
		09250A	SD-02 Shop Drawings															
			Steel Framing	3.1	G													
			Fire-Resistant Assemblies	3.6	G													
			SD-07 Certificates															
			Gypsum Board	2.2	G													
			Steel Framing	3.1	G													
			Fire-Rated Gypsum Board	2.2.1	G													
		09310A	SD-03 Product Data															
			Tile	2.1														
			Tile	2.1														
			Setting-Bed	3.7.2														
			Mortar and Grout	2.4														
			Mortar and Grout	2.4														
			Marble	1.6														
			Granite	2.8														

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		09310A	Granite	2.8														
			Traventino	2.8	G	G												
			Traventino	2.8	G	G												
			SD-04 Samples															
			Tile	2.1	G													
			Accessories	2.1.2														
			Marble Thresholds	2.5	G													
			Marble	1.6	G													
			Granite	2.8	G													
			Tranventino		G													
			SD-07 Certificates															
			Tile	2.1														
			Mortar and Grout	2.4														
			Granite	2.8														
			Traventino	2.8	G													
		09562	SD-02 Shop Drawings															
			Refurbishment		G													
			SD-03 Product Data															
			Operating Instructions															
			SD-07 Certificates															
			Restorer Qualifications		G													
		09640A	SD-03 Product Data															
			Installation	3.2														
			SD-04 Samples															
			Strip Flooring	2.1	G													
		09650A	SD-03 Product Data															

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		09650A	Resilient Flooring and															
			Accessories															
			SD-04 Samples															
			Flooring	3.2	G													
		09680A	SD-02 Shop Drawings															
			Installation	3.2														
			Molding	2.3														
			SD-03 Product Data															
			Carpet	2.1														
			Cushion	2.2	G													
			Surface Preparation	3.1														
			Installation	3.2														
			Regulatory Requirements	1.3														
			SD-04 Samples															
			Carpet	2.1	G													
			Molding	2.3	G													
			SD-07 Certificates															
			Carpet	2.1														
			SD-10 Operation and Maintenance															
			Data															
			Carpet	2.1	G													
			Cleaning and Protection	3.3	G													
		09900A	SD-03 Product Data															
			Paint	2.1														
			Mixing and Thinning	3.3														
			Application	3.4														

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		09900A	SD-04 Samples															
			Paint	2.1														
			SD-06 Test Reports															
			Paint	2.1														
			SD-07 Certificates															
			Lead	2.1.3														
			Mildewcide and Insecticide	2.1.2														
			Volatile Organic Compound	2.1.5														
			(VOC) Content															
		10300	SD-03 Product Data															
			Gas Logs	2.1														
		10800A	SD-03 Product Data															
			Finishes	2.1.2														
			Accessory Items	2.2														
			Frameless Shower Enclosure	2.3														
			SD-04 Samples															
			Finishes	2.1.2	G													
			Accessory Items	2.2	G													
		11401N	SD-03 Product Data															
			Kitchen equipment	2.1	G													
			SD-08 Manufacturer’s Instructions															
			Kitchen equipment	2.1														
		12320	SD-02 Shop Drawings															
			Cabinets	2.2														
			Countertops	2.3	G													
			SD-03 Product Data															

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		12320	Cabinets	2.2														
			Countertops	2.3	G													
			SD-04 Samples															
			Cabinets	2.2														
			Countertops	2.3	G													
			SD-06 Test Reports															
			Cabinets	2.2														
			Countertops	2.3	G													
			SD-07 Certificates															
			Cabinets	2.2														
			Countertops	2.3	G													
		13281	SD-02 Shop Drawings															
			Decontamination	3.1.3.3	G													
			SD-03 Product Data															
			Local exhaust equipment;	3.1.5	G													
			Vacuums	3.1.6	G													
			Vacuum filters	3.1.2	G													
			Respirators;	3.1.1.1	G													
			Pressure differential automatic recording instrument;	3.1.5	G													
			Amended water	1.2	G													
			Glovebags;	3.1.8	G													
			Encapsulants	2.1	G													
			Water filtration equipment	3.1.3.3														
			filters	3.1.3.3	G													
			SD-08 Manufacturer’s Instructions															

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		13281	Material safety data sheets	1.3.8	G													
			(MSDS) for all materials															
			SD-07 Certificates															
			Asbestos hazard abatement plan	1.4.1	G													
			Respiratory protection program	1.4.2	G													
			Hazard communication program	1.4.3	G													
			SD-06 Test Reports															
			Air sampling results	1.4.4	G													
			Exposure assessment	3.10.2	G													
			Pressure differential recordings for	1.4.5	G													
			local exhaust system															
			Asbestos disposal quantity report	3.12.3	G													
			Final Clearance Air Monitoring	3.10.6	G													
			Final Clearance Air Monitoring	3.10.6	G													
			SD-07 Certificates															
			Contractor's Qualifications	1.4.6.1	G													
			Private qualified person	1.4.6.2	G													
			documentation															
			Supervisor (Competent Person)	1.4.6.3	G													
			documentation															
			Testing laboratory	1.4.6.4	G													
			Landfill approval	1.4.6.5	G													
			Employee training	1.4.6.6	G													
			Medical certification	1.4.6.7	G													
			encapsulants	2.1	G													
			Water filtration equipment;	3.1.3.3	G													

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		13281	ventilation systems	3.1.6	G													
			Vacuums	3.1.6														
			vacuum filters	3.1.2	G													
			equipment used to contain	3.1	G													
			airborne asbestos fibers;															
			SD-01 Preconstruction Submittals															
			Notifications	1.4.7	G													
			Rental equipment	1.4.8	G													
			Respirator program records	1.4.9	G													
			Permits and licenses	1.3.4	G													
			Waste shipment records	1.4.6.5	G													
		13283	SD-02 Shop Drawings															
			Decontamination Facilities	3.1.7	G													
			SD-03 Product Data															
			Vacuums	1.13.4	G													
			Vacuum filters	1.13.5	G													
			Respirators	1.13.1	G													
			Chemical Paint Strippers	1.13.7	G													
			Chemical Paint Stripper	1.13.8	G													
			Neutralizer															
			Detergents and Cleaners	1.13.9	G													
			SD-06 Test Reports															
			Area air sampling	3.2.2	G													
			Exposure air monitoring	3.2.2	G													
			Local exhaust equipment	3.1.9														
			SD-07 Certificates															

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		13283	Lead-Based	1.9	G													
			Paint/Lead-Containing Paint Work															
			Plan															
			Rental equipment notification	1.13.3	G													
			Respiratory protection program	1.12.4	G													
			Hazard communication program	1.12.5	G													
			disposal facility	3.4.5	G													
			Hazardous waste management	1.12.6.1	G													
			plan															
			Waste handling and site storage	1.12.6.2	G													
			plan															
			Emergency contingency plan	1.12.6.3	G													
			Contractor's qualifications	1.5	G													
			Qualifications of CP	1.6	G													
			Third party consultant	1.7	G													
			qualifications															
			Testing laboratory qualifications	1.8	G													
			medical examinations	1.12.1	G													
			training certification	1.12.3.1	G													
			Vacuum filters	1.13.5	G													
			SD-08 Manufacturer’s Instructions															
			Chemicals	2.1	G													
			Material safety data sheets	2.1	G													
			SD-11 Closeout Submittals															
			manifest	3.4.5	G													
			Clearance Sampling Report	3.4.2														

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		15080	SD-04 Samples															
			Thermal Insulation Materials		G ED													
		15190	SD-02 Shop Drawings															
			Gas Piping System	3.2														
			SD-03 Product Data															
			Qualifications															
			SD-06 Test Reports															
			Testing		G RE													
			Pressure Tests	3.15.1														
			G], RE															
			Test With Gas	3.15.2	G RE													
		15400	SD-02 Shop Drawings															
			Plumbing System	3.6.1														
			SD-03 Product Data															
			Plumbing Fixture Schedule	3.7														
			G , ED															
			Plumbing System	3.6.1														
			SD-06 Test Reports															
			Tests, Flushing and Disinfection	3.6	G RE													
			SD-07 Certificates															
			Materials and Equipment															
			SD-10 Operation and Maintenance															
			Data															
			Plumbing System	3.6.1														
		15566	SD-02 Shop Drawings															
			Heating Equipment		G													

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		15566	ED															
			Installation	3.1	G													
			SD-03 Product Data															
			Heating Equipment		G													
			ED															
			Tests	3.4														
			Tests	3.4														
			System Diagrams		G													
			Similar Services															
			Field Training	3.5														
			SD-06 Test Reports															
			Tests	3.4	G													
			ED															
			SD-10 Operation and Maintenance															
			Data															
			Heating Equipment															
		15569	SD-02 Shop Drawings															
			Heating System		G ED													
			Piping Installation	3.2	G ED													
			Installation	3.2.4.3	G ED													
			Installation	3.2.7	G ED													
			SD-03 Product Data															
			Manufacturer's Catalog Data		G ED													
			Spare Parts Data															
			Water Treatment Plan															
			Heating System Tests	3.6	G ED													

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CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15569	Fuel System Tests	3.8	G	RE												
			Qualification															
			Field Instructions	3.9	G	ED												
			Tests	3.3	G	RE												
			SD-06 Test Reports															
			Heating System Tests	3.6	G	ED												
			Fuel System Tests	3.8	G	RE												
			SD-07 Certificates															
			Continuous Emissions Monitoring															
			SD-10 Operation and Maintenance															
			Data															
			Heating System															
			Water Treatment System	2.11														
		15653	SD-02 Shop Drawings															
			Drawings	1.4.2	G													
			ED															
			SD-03 Product Data															
			Air-Conditioning System		G													
			ED															
			Spare Parts Data															
			Framed Instructions	3.1.8														
			Qualifications		G													
			Verification of Dimensions	1.4.1														
			SD-06 Test Reports															
			Tests	3.2	G													
			ED															

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		15653	System Performance Tests	3.2.2	G													
			SD-07 Certificates															
			Air-Conditioning															
			Service Organizations															
			SD-10 Operation and Maintenance															
			Data															
			Operation	2.3														
			Operation	3.4														
			Maintenance Manuals	3.4														
		15895	SD-02 Shop Drawings															
			Drawings															
			SD-03 Product Data															
			Components and Equipment	2.1	G													
			ED															
			Test Procedures															
			Similar Services															
			Testing, Adjusting and Balancing	3.3														
			Field Training	3.5														
			SD-06 Test Reports															
			Performance Tests	3.4														
		15990	SD-02 Shop Drawings															
			TAB Schematic Drawings and	3.3	G ED													
			Report Forms															
			SD-03 Product Data															
			TAB Procedures	3.5.1	G													
			Calibration	1.4	G ED													

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		15990	Systems Readiness Check	3.5.2														
			TAB Execution	3.5.1	G	RE												
			TAB Verification	3.5.4	G	RE												
			SD-06 Test Reports															
			Design Review Report	3.1	G	ED												
			Systems Readiness Check	3.5.2	G	ED												
			TAB Report	3.5.3	G	ED												
			TAB Verification Report	3.5.4	G	ED												
			SD-07 Certificates															
			Ductwork Leak Testing	3.4	G	ED												
			TAB Firm	1.5.1	G	ED												
			TAB Specialist	1.5.2	G	ED												
		16415A	SD-02 Shop Drawings															
			Interior Electrical Equipment															
			SD-03 Product Data															
			Manufacturer's Catalog		G													
			Material, Equipment, and Fixture		G													
			Lists															
			Installation Procedures		G													
			As-Built Drawings	1.2.6	G													
			Onsite Tests		G													
			SD-06 Test Reports															
			Factory Test Reports		G													
			Field Test Plan		G													
			Field Test Reports	3.19	G													
			SD-07 Certificates															

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		16415A	Materials and Equipment	1.4														
			FIO															
		16710A	SD-02 Shop Drawings															
			Premises Distribution System	1.7	G													
			Record Drawings		G													
			SD-03 Product Data															
			Record Keeping and	1.8	G													
			Documentation															
			Spare Parts															
			Manufacturer's Recommendations	3.1.2	G													
			Test Plan		G													
			Qualifications	1.4	G													
			SD-06 Test Reports															
			Test Reports															
			SD-07 Certificates															
			Premises Distribution System	1.7														
			Materials and Equipment	2.1	G													
			Installers		G													